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THE
AMERICAN NATURALIST.

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WHY CERTAIN KINDS OF TIMBER PREVAIL IN
CERTAIN LOCALITIES.

BY JOHN T. CAMPBELL.

IT has often been observed that in certain localities a certain species of timber will prevail, or be more numerous than any, and sometimes than every other kind. It has been further observed that when any prevailing timber has been cleared away, and the land allowed to grow up again in timber, that some other species will prevail. This, I think, has often been erroneously attributed to the inability or indisposition of the soil to reproduce the former prevailing timber. I have observed much on this subject, and I never could see any important difference in the ability or disposition of the soil to nourish any of the different kinds of native trees, and also no important difference in the success in planting and starting them.

My observations convince me that it all, or mainly, lies in the favorable condition of the ground to receive the seeds of the various species of timber when it happens to fall thereon. A sycamore in the Wabash region will grow as large and rapidly on the uplands, where they are seldom found, as in the sandy bottoms along the margins of the streams, where they seem to best thrive. A white oak when planted will grow as well in the low river bottoms, where they are never or seldom found, as on the hills and ridges near by, where they seem to be the spontaneous product of the ground.

But if an acorn should be blown from a white oak on the hills into the low bottoms beneath, it would fall on ground very unfavorable to the sprouting of such acorns, and it would rot where it fell. So, on the other hand, if a sycamore ball (which contains

one thousand to two thousand seeds) should, in the spring time, be blown to pieces after the winter's freeze, and their needle-like seeds be blown upon the adjacent hills, very few of them would light on ground favorable to sprouting them. Occasionally we find a lone sycamore on the uplands, standing among the oak, beech, poplar and other upland timber, and every year bearing its quota of seed and shedding them on the adjacent ground by the million, none, or very few of which, ever take effect, and for reasons before hinted at, but which will be more fully explained further on.

The sycamore seed must fall on ground, warm, very moist, but not absolutely wet, and sufficiently bare for the sun to shine on it the greater part of the day. Otherwise it may not sprout. The acorn, on the other hand, falls a little while before the leaves fall. If it falls on very moist ground it rots. If it falls on the leaves of the former year, and is shaded enough to prevent drying or baking from the sun, and is covered lightly by the fall of the current year's leaves, or by a chance wind has the old leaves drifted on top of it, a slow rain with subsequent sunshine will sprout it. It will send out little rootlets which bore through the underlying old leaves and penetrate the ground, and once started, no weather or climatic conditions will kill it. The same is true of the seed of the hickory, beech, sugar maple and other upland trees.

During the past two years my work has been on and about the Wabash river banks and its bottoms (flood-plains), and I have discovered why it is that in some parts of these bottoms one kind of timber, as sycamore, will take complete possession of a few acres, while at or near by the cottonwood will prevail almost to the exclusion of everything else, and at other places the soft or water maple will do likewise, and at still another the water elm will monopolize all the space on which a grown tree can stand for several acres.

It comes about in this way. The balls of the sycamore, after undergoing the winter's freeze, are dissolved so that the separate, needle-like, or more properly pin-like seeds (as the outer end has the germ of the root, and swells into a bulb like a pin-head) are blown by the wind, the little "fuz" they hold enabling them to float a great way both in wind and on water. They begin falling early in the spring months, and if a flood is receding at the time, they stick to the soft, moist banks wherever they

touch them, and particularly along the highest part of the sand bars. Were it not for the subsequent floods the same spring, there could no other trees grow, as the sycamore, being the first to shed, would seed all the tree-growing space (each large tree bearing one hundred and fifty million seeds), and their broad leaves would shade the ground till nothing else could sprout. But during their early infancy they are easily killed by an overflow, and this ill fortune happens to the greater portion of them.

The cottonwood is the next in order of shedding seed. If another flood is receding while the cottonwood is shedding, this flood will have killed all the sycamores which it covered for only a few days, and will sprout all the cottonwood seed that may fall on and along the banks and bars. As the earlier floods are generally the highest there will be some sycamores not reached by the following floods, and they will hold sway along that margin. If, when the cottonwoods are a few inches high, another flood follows, they too will be killed to the extent that they are kept under water a few days.

Next to the cottonwood the soft, or bottom maple sheds its seed. If a flood is receding this seed will occupy all the space, as, having a smaller leaf than the sycamore or cottonwood, they will grow closer together. They in turn may be killed by a flood when they are very young.

I have forgotten the exact time that each of these trees sheds its seed, something will of course depend on the forwardness of the spring. But along the Wabash banks, last spring, I could see three belts of young trees, and distinguish them by their general appearance. The farther off, the plainer these belts show, till lost to view. The upper belt was sycamore, the second (downward) cottonwood, and the third soft maple. In June following there came a bigger flood than any that caused the seeds to sprout, and killed all of them. There was a much bigger flood in the preceding February, but no seed fell then.

It will sometimes happen that the flood that plants the sycamores will be the last one for that year, and when they have lived through one summer they are safe from any danger from overflow. In still other seasons it will happen to favor the cottonwood, or the maple, or elm, or willow. New bars are all the time extending from the lower ends of the old ones, and as the elevation of these will be such as to be sometimes flooded once and

not again for that year, the trees that shed their seed with the flood that barely covers such bars will plant them to overflowing fullness of their kind, and once they are secure from other floods they live out their time of two hundred to three hundred years.

The upper surface of the interior of the bottoms (back from the rivers) is built up by sedimentation, and when built above the height of the average floods, the burr oak, black walnut, buckeye, pawpaw and bottom hickory make their appearance. Such sycamores, cottonwoods and maples as live long enough to be relegated to the interior (as very few of them do) by the bottoms building riverward away from them, do not and cannot reproduce themselves, as the conditions that sprout their seeds have moved away from them. They die at the end of three hundred years at most, and leave no heirs to the soil.

How do the occasional lone, stray sycamore and cottonwood find their way to the uplands? I can see how in one case it was not only possible but very probable. Five miles south-east of where I am now writing (Rockville, Indiana) is a pasture of hill land, so fenced as to include a section of a small stream at the foot of a hill facing north. There stand several half-grown sycamores which bear and shed their seed in this corner watering place. There these seeds are sprouted. There the cattle and horses resort for water. Every thimbleful of mud that may stick to their hoofs is liable to contain from one to five half-sprouted seeds, which are carried up the hillside and on the upland, as the cattle and horses return to their grass, and dropped where the sun takes up the unfinished work of growing the tree. The result is, that on every square rod of ground near this watering place stands one to five sycamores, varying in age from one to ten years, and they diminish in number as the distance from the watering place increases. It has been used as a pasture about ten years. I remember when it contained no sycamore at all. Just outside of the pasture fence, to the eastward, the land has never been fenced. The cows may drink where they please, and there are no sycamores scattered over the adjacent hills. If any seeds are thus carried there, the forest leaves and shade prevent their sprouting and growing. But along the little sand and gravel bars of the stream, they sprout as thick as grass, only to be killed by the floods from the early summer showers.

From this I infer that two hundred to three hundred years ago the deer, elk and buffalo in their many wanderings across streams and over hills, have occasionally carried in their hoofs partly sprouted seeds, and dropped them on the hills where the sunshine was unobstructed, and the trees thus got their footing, and once getting it were able to stand afterward. These are the only kinds of trees I have observed, but I presume a similar law governs the distribution and self-planting of them all.

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ON THE EVOLUTION OF THE VERTEBRATA, PROGRESSIVE AND RETROGRESSIVE.

BY E. D. COPE.

(Continued from page 247, March number.)

THE REPTILIAN LINE—CONTINUED.

IN the first place, this line departs with lapse of time from the primitive and ancestral order, the Theromorpha, in two respects. First in the loss of the capitular articulation of the ribs, and second in the gradual elongation and final freedom of the suspensory bone of the lower jaw (the os quadratum). In so departing from the Theromorpha, it also departs from the mammalian type. The ribs assume the less perfect kind of attachment which the mammals only exhibit in some of the whales, and the articulation of the lower jaw loses in strength, while it gains in extensibility, as is seen in the development of the line of the eels among fishes. The end of this series, the snakes, must therefore be said to be the result of a process of creation by degeneration, and their lack of scapular arch and fore limb and usual lack of pelvic arch and hind limb are confirmatory evidence of the truth of this view of the case.

Secondly, as regards the ossification of the anterior part of the brain-case. This is deficient in some of the Theromorpha, the ancestral order, which resemble in this, as in many other things, the cotemporary Batrachia. Some of them, however (*Diadectidæ*), have the brain completely enclosed in front. The late orders mostly have the anterior walls membranous, but in the streptostylic series at the end, the skull becomes entirely closed in front. In this respect then the snakes may be said to be the highest or most perfect order.

As regards the scapular arch, no order possesses as many ele-

ments as thoroughly articulated for the use of the anterior leg as the Permian Theromorpha. In all the orders there is loss of parts, excepting only in the Ornithosauria and the Lacertilia. In the former the adaptation is to flying. The latter retain nearly the Theromorph type. An especial side development is the modification of abdominal bones into two peculiar elements to be united with the scapular arch into a plastron, seen in the Testudinata. In this part of the skeleton the orders are generally degenerate, the last one, the Ophidia, especially so.

The pelvic arch has a more simple history. Again in the Theromorpha we have the nearest approach to the Mammalia. The only other order which displays similar characters is the Ornithosauria (Dimorphodon, according to Seeley). In the Dinosauria we have a side modification which is an adaptation to the erect or bipedal mode of progression, the inferior bones being thrown backwards so as to support the viscera in a more posterior position. This is an obvious necessity to a bipedal animal where the vertebral column is not perpendicular, as in birds. And it is from the Dinosauria that the birds are supposed to have arisen. The main line of the Reptilia, however, departs from both the mammalian and the avian type and loses in strength. In the latest orders, the Pythonomorpha and Ophidia, the pelvis is rudimental or absent.

As regards the limbs, the degeneracy is well marked. No reptilian order of later ages approaches so near to the Mammalia in these parts as do the Permian Theromorpha. This approximation is seen in the internal epicondylar foramen and well developed condyles of the humerus, and in the well differentiated seven bones of the tarsus. The epicondylar foramen is only retained in later reptiles in the Rhynchocephalian Hatteria (Dollo); and the condyles of the Dinosauria and all of the other orders, excepting the Ornithosauria and some Lacertilia, are greatly wanting in the strong characterization seen in the Theromorpha. The posterior foot seems to have stamped out the greater part of the tarsus in the huge Dinosauria, and it is reduced, though to a less degree, in all the other orders. In the paddled Sauropterygia, dwellers in the sea, the tarsus and carpus have lost all characterization, probably by a process of degeneracy, as in the mammalian whales. This is to be inferred from the comparatively late period of their appearance in time. The

still more unspecialized feet and limbs of the Ichthyosaurus (Ichthyopterygia) cannot yet be ascribed to degeneracy, for their history is too little known. At the end of the line the snakes present us with another evidence of degeneracy. But few have a pelvic arch (Stenostomidæ Peters), while very few (Peropoda) have any trace of a posterior limb.

The vertebræ are not introduced into the definitions of the orders, since they are not so exclusively distinctive as many other parts of the skeleton. They nevertheless must not be overlooked. As in the Batrachia the Permian orders show inferiority in the deficient ossification of the centrum. Many of the Theromorpha are notochordal, a character not found in any later order of reptiles excepting in a few Lacertilia (Geconidæ). They thus differ from the Mammalia, whose characters are approached more nearly by some of the terrestrial Dinosauria in this respect. Leaving this order we soon reach the prevalent ball and socket type of the majority of Reptilia. This strong kind of articulation is a need which accompanies the more elongated column which itself results at first from the posterior direction of the ilium. In the order with the longest column, the Ophidia, a second articulation, the zygosphen, is introduced. The mechanical value of the later reptilian vertebral structure is obvious, and in this respect the class may be said to present a higher or more perfect condition than the Mammalia.

In review it may be said of the reptilian line, that it exhibits marked degeneracy in its skeletal structure since the Permian epoch; the exception to this statement being in the nature of the articulations of the vertebræ. And this specialization is an adaptation to one of the conditions of degeneracy, viz., the weakening and final loss of the limbs and the arches to which they are attached.

The history of the development of the brain in the Reptilia presents some interesting facts. In the Diadectid family of the Permian Theromorpha it is smaller than in a *Boa constrictor*, but larger than in some of the Jurassic Dinosauria. Marsh has shown that some of the latter possess brains of relatively very narrow hemispheres, so that in this organ those gigantic reptiles were degenerate, while the existing streptostylic orders have advanced beyond their Permian ancestors.

There are many remarkable cases of what may now be safely

called degradation to be seen in the contents of the orders of reptiles.¹ Among tortoises may be cited the loss of the rib-heads and of one or two series of phalanges in the especially terrestrial family of the Testudinidæ. The cases among the Lacertilia are the most remarkable. The entire families of the Pygopodidæ, the Aniellidæ, the Anelytropidæ and the Dibamidæ are degraded from superior forms. In the Anguidæ, Teidæ and Scincidæ we have series of forms whose steps are measured by the loss of a pair of limbs, or of from one to all the digits, and even to all the limbs. In some series the surangular bone is lost. In others the eye diminishes in size, loses its lids, loses the folds of the epidermis which distinguish the cornea, and finally is entirely obscured by the thickening of the cornea and closure of the ophthalmic orifice in the true skin. Among the snakes a similar degradation of the organs of sight has taken place in the order of the Scolecophidia, which live under ground, and often in ants' nests. The Tortricidæ and Uropeltidæ are burrowing snakes which display some of the earlier stages of this process. One genus of the true snakes even (according to Günther) has the eyes obscured as completely as those of the inferior types above named (genus *Typhlogeophis*).

VII. THE AVIAN LINE.

The palæontology of the birds not being well known, our conclusions respecting the character of their evolution must be very incomplete. A few lines of succession are, however, quite obvious, and some of them are clearly lines of progress, and others are lines of retrogression. The first bird we know at all completely, is the celebrated *Archeopteryx* of the Solenhofen slates of the Jurassic period. In its elongate series of caudal vertebræ and the persistent digits of the anterior limbs we have a clear indication of the process of change which has produced the true birds, and we can see that it involves a specialization of a very pronounced sort. The later forms described by Seeley and Marsh from the Cretaceous beds of England and North America, some of which have biconcave vertebræ, and all probably, the American forms certainly, possessed teeth. This latter character was evidently speedily lost, and others more characteristic of the subclass became the field of developmental change. The parts

¹ Such forms in the Lacertilia have been regarded as degradational by Lankester and Boulanger.

which subsequently attained especial development are the wings and their appendages; the feet and their envelopes, and the vocal organs. Taking all things into consideration the greatest sum of progress has been made by the perching birds, whose feet have become effective organs for grasping, whose vocal organs are most perfect and whose flight is generally good, and often very good. In these birds also the circulatory system is most modified, in the loss of one of the carotid arteries.

The power of flight, the especially avian character, has been developed most irregularly, as it appears in all the orders in especial cases. This is apparent so early as in the Cretaceous toothed birds already mentioned. According to Marsh the Hesperornithidæ have rudimental wings, while these organs are well developed in the Ichthyornithidæ. They are well developed among natatorial forms in the albatrosses and frigate pelicans, and in the skuas, gulls and terns; among rasorial types the sand-grouse, and among the adjacent forms, the pigeons. Then among the lower insessores, the humming-birds exceed all birds in their powers of flight, and the swifts and some of the Caprimulgidæ are highly developed in this respect. Among the higher or true song birds, the swallows form a notable example. With these high specializations occur some remarkable deficiencies. Such are the reduction of the feet in the Caprimulgidæ swifts and swallows, and the foetal character of the bill in the same families. In the syndactyle families, represented by the kingfishers, the condition of the feet is evidently the result of a process of degeneration.

A great many significant points may be observed in the developmental history of the epidermic structures, especially in the feathers. The scale of change in this respect is in general a rising one, though various kinds of exceptions and variations occur. In the development of the rectrices (tail feathers) there are genera of the wading and rasorial types, and even in the insessorial series, where those feathers are greatly reduced or absolutely wanting. These are cases of degeneracy.

There is no doubt but that the avian series is in general an ascending one.

VIII. THE MAMMALIAN LINE.

Discoveries in palæontology have so far invalidated the accepted definitions of the orders of this class that it is difficult to

give a clearly cut analysis, especially from the skeleton alone. The following scheme, therefore, while it expresses the natural groupings and affinities, is defective in that some of the definitions are not without exceptions :

- I. A large coracoid bone articulating with the sternum.
Marsupial bones; fibula articulating with proximal end of astragalus
1. *Monotremata*.
- II. Coracoid a small process coössified with the scapula.
- a. Marsupial bones; palate with perforations (vagina double; placenta and corpus callosum rudimental or wanting; cerebral hemispheres small and smooth).
- But one deciduous molar tooth.....2. *Marsupialia*.
- aa. No marsupial bones; palate entire (one vagina; placenta and corpus callosum well developed).
- β. Anterior limb reduced to more or less inflexible paddles, posterior limbs wanting (*Mutilata*).
- No elbow joint; carpals discoid, and with the digits separated by cartilage; lower jaw without ascending ramus.....3. *Cetacea*.
- An elbow joint; carpals and phalanges with normal articulations; lower jaw with ascending ramus4. *Sirenia*.
- ββ. Anterior limbs with flexible joints and distinct digits; ungual phalanges not compressed, and acute at apex¹ (*Ungulata*²).
- γ. Tarsal bones in linear series; carpals generally in linear series.
- Limbs ambulatory; teeth with enamel.....5. *Taxeopoda*³.
- γγ. Tarsal series alternating; carpal series linear.
- Carpal series linear; no intermedium; fibula not interlocking with astragalus; no anapophyses; incisors rooted; hallux not opposable.....*Condylartha*.
- Carpal series linear; an intermedium; fibula interlocking with astragalus; hallux not opposable*Hyracoida*.
- An intermedium; fibula not interlocking; anapophyses; hallux opposable; incisors growing from persistent pulps*Daubentonoida*.
- An intermedium; fibula not interlocking; anapophyses; hallux opposable; incisors rooted; carpus generally linear*Quadrumana*.
- No intermedium;⁴ nor anapophyses; carpal rows alternating; incisors rooted
Anthropoida.
- The only difference between the *Taxeopoda* and the *Bunotheria* is in the unguliform terminal phalanges of the former as compared with the clawed or unguiculate form in the latter. The marmosets among the former division are, however, furnished with typical claws.
- Some may prefer to use the term *Primates* in place of *Taxeopoda*, and such may be the better course.
- Cuboid bone partly supporting navicular, not in contact with astragalus
7. *Proboscidea*.

¹ Except the *Hapalidæ*.

² Lamarck, *Zoologie Philosophique*, 1809.

³ This order has the following suborders, whose association is now made for the first time.

⁴ Except in *Pithecus* and *Hylobates*.

γγγ. Both tarsal and carpal series more or less alternating.

Os magnum not supporting scaphoides; cuboid supporting astragalus; superior molars tritubercular.....8. *Amblypoda*.

Os magnum supporting scaphoides; superior molars quadritubercular

9. *Diplarthra*.¹

βββ. Anterior limbs with flexible joints. Ungual phalanges compressed and pointed² (Unguiculata).

ε. Teeth without enamel; no incisors.

Limbs not volant; hemispheres small, smooth.....10. *Edentata*.

εε. Teeth with enamel; incisors present.

No postglenoid process; mandibular condyle round; limbs not volant; hemispheres

ERRATUM FOR APRIL NATURALIST.

Owing to the absence from the country of both the leading editors during last month, some typographical errors occur in the last number of the NATURALIST. The most important of these is on page 346, where a foot-note containing the classification of the Taxeopoda is included in the text of the classification of the Mammalia. Therefore, p. 346, lines two to eighteen from bottom, transfer to foot of page, under note 3. Ibid. bottom line, change "7" to 6, and numbers in following lines to coincide.

MONODACTYLA

¹ Except Pantolestes. This order includes the suborders Perissodactyla and Artiodactyla.

² Except Mesonyx.

³ Except Erinaceus.

⁴ With the suborders Insectivora, Creodonta, Tæniodonta and Tillodonta.

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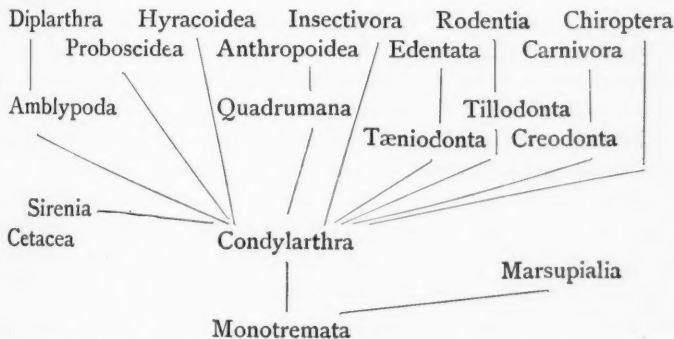
No postglenoid process; mandibular condyle round; limbs not volent; hemispheres small, smooth.....11. *Rodentia*.

Limbs volent; hemispheres small, smooth12. *Chiroptera*.

A postglenoid process; mandibular condyle transverse; limbs not volent, no scapholunar bone;³ hemispheres small, smooth.....13. *Bunotheria*.⁴

A postglenoid process; limbs not volent, with a scapholunar bone; hemispheres larger, convoluted14. *Carnivora*.

Palæontology has cleared up the phylogeny of most of these orders, but some of them remain as yet unexplained. This is the case with the Cetacea, the Sirenia and the Taxeopoda. The last-named order and the Marsupialia can be supposed with much probability to have come off from the Monotremata, but there is as yet no palæontological evidence to sustain the hypothesis. No progress has been made in unraveling the phylogeny of the Cetacea and Sirenia. The facts and hypotheses as to the phylogeny of the Mammalia may be represented in the following diagram :



¹ Except Pantolestes. This order includes the suborders Perissodactyla and Artiodactyla.

² Except Mesonyx.

³ Except Erinaceus.

⁴ With the suborders Insectivora, Creodonta, Tæniodonta and Tillodonta.

It will be readily seen from the above diagram that the discovery of the Condylarthra was an important event in the history of our knowledge of this subject. This suborder of the Lower Eocene epoch stands to the placental Mammalia in the same relation as the Theromorphous order does to the reptilian orders. It generalizes the characteristics of them all, and is apparently the parent stock of all, excepting perhaps the Cetacea. The discovery of the extinct Bunotherian suborders united together inseparably the clawed orders, excepting the bats; while the extinct order Amblypoda is the ancestor of the most specialized of the Ungulates, the odd and even-toed Diplarthra.

The characters of the skeleton of the order Monotremata show that it is nearest of kin to the Reptilia, and many subordinate characters point to the Theromorpha as its ancestral source.¹ In the general characters the Marsupialia naturally follow in a rising scale, as proven by the increasing perfection of the reproductive system. The Monodelphia follow with improvements in the reproductive system and the brain, as indicated in the table already given. The oldest Monodelphia were, in respect to the structure of the brain, much like the Marsupialia, and some of the existing orders resemble them in some parts of their brain-structure. Such are the Condylarthra and Amblypoda of extinct groups, and the Bunotheria, Edentata, Rodentia and Chiroptera, recent and extinct. The characters of the brains of Amblypoda and some Creodonta are, in their superficial characters, even inferior to existing marsupials. The divided uterus of these recent forms also gives them the position next to the Marsupialia. In the Carnivora, Hyracoidea and Proboscidea a decided advance in both brain structure and reproductive system is evident. The hemispheres increase in size and they become convoluted. A uterus is formed and the testes become external, etc. In the Quadrumana the culmination in these parts of the structure is reached, excepting only that in the lack of separation of the genital and urinary efferent ducts, the males are inferior to those of many of the Artiodactyla. This history displays a rising scale for the Mammalia.

Looking at the skeleton we observe the following successional modifications :²

¹ Proceedings American Philosoph. Society, 1884, p. 43.

² See the evidence for evolution in the history of the extinct Mammalia. Proceeds. Amer. Assoc. Adv. Science, 1883.

First, as to the feet, and (A) the digits. The Condylarthra have five digits on both feet, and they are plantigrade. This character is retained in their descendants of the lines of Anthro- poidea, Quadrumana and Hyracoidea, also in the Bunotheria, Edentata and most of the Rodentia. In the Amblypoda and Proboscidea the palm and heel are a little raised. In the Carnivora and Diplarthra the heel is raised, often very high, above the ground, and the number of toes is diminished, as is well known, to two in the Artiodactyla and one in the Perissodactyla. (B) The tarsus and carpus. In the Condylarthra the bones of the two series in the carpus and tarsus are opposite each other, so as to form continuous and separate longitudinal series of bones. This continues to be the case in the Hyracoidea and many of the Quadrumana, but in the anthropoid apes and man the second row is displaced inwards so as to alternate with a first row, thus interrupting the series in the longitudinal direction, and forming a stronger structure than that of the Condylarthra. In the Bunotherian rodent and edentate series, the tarsus continues to be without alternation, as in the Condylarthra, and is generally identical in the Carnivora. In the hoofed series proper it undergoes change. In the Proboscidea the carpus continues linear, while the tarsus alternates. In the Amblypoda the tarsus alternates in another fashion, and the carpal bones are on the inner side linear, and on the outer side alternating. The complete interlocking by universal alternation of the two carpal series is only found in the Diplarthra. (C) As to the ankle-joint. In most of the Condylarthra it is a flat joint or not tongued or grooved. In most of the Carnivora, in a few Rodentia, and in all Diplarthra, it is deeply tongued and grooved, forming a more perfect and stronger joint than in the other orders, where the surfaces of the tibia and astragalus are flat. (D) In the highest forms of the Rodentia and Diplarthra the fibula and ulna become more or less coössified with the tibia and radius, and their middle portions become alternated or disappear.

Secondly, as regards the vertebræ. The mutual articulations (zygapophyses) in the Condylarthra are flat and nearly horizontal. In higher forms, especially of the ungulate series, they become curved, the posterior turning upwards and outwards, and the anterior embracing them on the external side. In the higher Diplarthra this curvature is followed by another curvature of the

postzygapophysis upwards and outwards, so that the vertical section of the face of this process is an S. Thus is formed a very close and secure joint, such as is nowhere seen in any other Vertebrata.

Thirdly, as regards the dentition. Of the two types of Monotremata, the Tachyglossidæ and the Platypodidæ, the known genera of the former possess no teeth, and the known genus of the latter possesses only a single corneous epidermic grinder in each jaw. As the Theromorphous reptiles from which these are descended have well developed teeth, their condition is evidently one of degeneration, and we can look for well toothed forms of Monotremata in the beds of the Triassic and Jurassic periods. Perhaps some such are already known from jaws and teeth. In the marsupial order we have a great range of dental structure, which almost epitomizes that of the Monodelph orders. The dentition of the carnivorous forms is creodont; of the kangaroos is perissodactyle, and that of the wombats is rodent. Other forms repeat the Insectivora. I therefore consider the placental series especially. I have already shown that the greater number of the types of this series have derived the characters of their molar teeth from the stages of the following succession. First a simple cone or reptilian crown, alternating with that of the other jaw. Second, a cone with lateral denticles. Third, the denticles to the inner side of the crown forming a three-sided prism, with tritubercular apex, which alternates with that of the opposite jaw. Fourth, development of a heel projecting from the posterior base of the lower jaw, which meets the crown of the superior, forming a tubercular-sectorial inferior molar. From this stage the carnivorous and sectorial dentition is derived, the tritubercular type being retained. Fifth, the development of a posterior inner cusp of the superior molar and the elevation of the heel of the inferior molar, with the loss of the anterior inner cusp. Thus the molars become quadritubercular, and opposite. This is the type of many of the Taxeopoda, including the Quadrumana and Insectivora as well as the inferior Diplarthra. The higher Taxeopoda (Hyracoidea) and Diplarthra add various complexities. Thus the tubercles become flattened and then concave, so as to form Vs in the section produced by wearing, or they are joined by cross-folds, forming various patterns. In the Proboscidea they become multiplied so as to produce numerous cross-crests.

The dentition of some of the Sirenia is like that of some of the Ungulata, especially of the suilline group, while in others the teeth consist of cylinders. In the Cetacea the molars of the oldest (Eocene and Miocene) types are but two-rooted and compressed, having much the form of the premolars of other Mammalia. In existing forms a few have simple conical teeth, while in a considerable number teeth are entirely wanting.

A review of the characters of the existing Mammalia as compared with those of their extinct ancestors displays a great deal of improvement in many ways, and but few instances of retrogression. The succession in time of the Monotremata, the Marsupialia, and the Monodelphia, is a succession of advance in all the characters of the soft parts and the skeleton which define them (see table of classification). As to the monotremes themselves, it is more than probable that the order has degenerated in some respects in producing the existing types. The history of the Marsupialia is not made out, but the earliest forms of which we know the skeleton, *Polymastodon* (Cope) of the Lower Eocene, is as specialized as the most specialized recent forms. The dentition of the Jurassic forms, *Plagiaulax*, etc., is quite specialized also, but not more so than that of the kangaroos. The premolars are more specialized, the true molars less specialized than in those animals.

Coming to the Monodelphia the increase in the size and complication of the brain, both of the cerebellum and the hemispheres, is a remarkable evidence of advance. But one retrogressive line in this respect is known, viz., that of the order Amblypoda,¹ where the brain has become relatively smaller with the passage of time. The successive changes in the structure of the feet are all in one direction, viz., in the reduction of the number of the toes, the elevation of the heel and the creation of tongue and groove joints where plain surfaces has previously existed. The diminution in the number of toes might be regarded as a degeneracy, but the loss is accompanied by a proportional gain in the size of the toes that remain. In every respect the progressive change in the feet is an advance. In the carpus and tarsus we have a gradual rotation of the second row of bones on the first, to the inner side. In the highest and latest orders this process is most complete, and as it results in a more

¹See NATURALIST, Jan., 1885, p. 55.

perfect mechanical arrangement, the change is clearly an advance. The same progressive improvement is seen in the development of distinct facets in the cubito-carpal articulation, and of a tongue and groove ("intertrochlear crest") in the elbow-joint. In the vertebræ the development of the interlocking zygapophysial articulations is a clear advance.

Progress is generally noticeable in the dental structures; unlike the marsupial line the earliest dentitions are the most simple, and the later the more complex. Some of the types retain the primitive tritubercular molars, as the Centetidæ, shrews and some lemurs, and many Carnivora, but the quadritubercular and its derivative forms is by far the most common type in the recent fauna. The forms that produced the complicated modifications in the Proboscidea and Diplarthra appeared latest in time, and the most complex genera, *Bos* and *Equus*, the latest of all. The extreme sectorial modifications of the tritubercular type, as seen in the Hyænidæ and the Felidæ, are the latest of their line also.

Some cases of degeneracy are, however, apparent in the monodelphous Mammalia. The loss of pelvis and posterior limbs in the two mutilate orders is clearly a degenerate character, since there can be no doubt but that they have descended from forms with those parts of the skeleton present. The reduction of flexibility seen in the limbs of the Sirenia and the loss of this character in the fore limbs of the Cetacea are features of degeneracy for the same reason. The teeth in both orders have undergone degenerate evolution, to extinction in the later and existing forms of the Cetacea. The Edentata appears to have undergone degeneration. This is chiefly apparent in the teeth which are deprived of enamel, and which are wanting from the premaxillary bone. A suborder of the Bunotheria, the Tæniodonta of the Lower Eocene period, display a great reduction of enamel on the molar teeth, so that in much worn examples it appears to be wanting. Its place is taken by an extensive coat of cementum, as is seen in Edentata, and the teeth are ever rootless as in that order. It is probable that the Edentata are the descendants of the Tæniodonta by a process of degeneracy.

Local or sporadic cases of degenerate loss of parts are seen in various parts of the mammalian series, such are toothless Mammalia wherever they occur. Such are cases where the teeth become extremely simple, as in the honey-eating marsupial *Tarsipes*,

the carnivore *Proteles*, the Pteropod bats, and the aye-aye. Also where teeth are lost from the series, as in the canine genus *Dysodus*, and in man. The loss of the hallux and pollex without corresponding gain, in various genera, may be regarded in the same light.

In conclusion, the progressive may be compared with the retrogressive evolution of the Vertebrata, as follows: In the earlier periods and with the lower forms, retrogressive evolution predominated. In the higher classes progressive evolution has predominated. When we consider the history of the first class of vertebrates, the Tunicata, in this respect, and compare it with that of the last class, the Mammalia, the contrast is very great.

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PROGRESS OF NORTH AMERICAN INVERTEBRATE PALÆONTOLOGY FOR 1884.

BY J. B. MARCOU.

THE year that has just passed has been fairly prolific in palæontological work, about fifteen more titles appearing in this review than there were in the last; it is true that a few of them should have been inserted last year, but doubtless some titles have escaped me also this year, and the two errors may be considered to compensate each other; so that we have an increase of about one-third in the number of articles published. There is also a general improvement in the quality of illustrations, though of course there is still plenty of room for improvement, and it is surprising that some palæontologists should persist in publishing a large number of descriptions with no illustrations at all, or with such imperfect illustrations as to render them practically useless; the chief result brought about by such publication of species is an increase of our already voluminous synonymy. The day will doubtless come when descriptions of new species unaccompanied by proper diagnoses and illustrations will no longer be recognized, for it is next to impossible to recognize a form from a meager description unaccompanied by an illustration. The founding of new genera and species on very imperfect specimens is also a very reprehensible practice, for although it may be excellent exercise for the imagination of the author, yet it may introduce errors which it will take a great deal of time and trouble to eradicate, especially when there is no indication that such descriptions

and figures are restored according to the idea that the author had of the way in which they ought to be.

This year we have the first volume of the Transactions of the Royal Society of Canada. The committee on publication cannot be too severely criticised for having printed a large quarto of about 700 pages, containing many interesting papers, without any index, and for using five different systems of pagination, as well as varying the system of headings for each page.

H. M. Ami has notes on *Triarthrus spinosus* in the Trans. Ottawa Field Nat. Club.

Chas. E. Beecher, in Report. P.P.P. 2d Geol. Surv. Penna., has an excellent article on the "Ceratiocaridæ from the Chemung and Waverley groups at Warren, Pennsylvania."

W. B. Billings has "Notes on, and description of some fossils from the Trenton limestone," in the Trans. Ottawa Field Nat. Club.

E. J. Chapman publishes, in the Trans. Roy. Soc. Canada, a "Classification of Crinoids" based on the presence or absence of a canaliculated structure in the calyx and arm plates.

E. W. Claypole has an article "On the occurrence of the genus *Dalmanites* in the Lower Carboniferous rocks of Ohio," in the *Geological Magazine* for July; also a Preliminary note on some fossil Fishes recently discovered in the Silurian rocks of North America, in the AMERICAN NATURALIST for December.

William B. Dwight, in the *Amer. Journ. of Science and Arts* for April, has his fourth article on "Recent explorations in the Wappinger Valley limestone of Dutchess county, New York, No. 4, Descriptions of Calciferous ? fossils."

Aug. F. Foerste, in the AMERICAN NATURALIST for January, has a note on "The power of motion in Crinoid stems."

W. M. Fontaine, in the monographs of the U. S. Geol. Survey, has published his "Contributions to the knowledge of the older Mesozoic flora of Virginia." This work is divided into three parts; in the first the author gives a brief description of the geology of the Virginia Mesozoic areas. In the second he describes the flora and compares it with plants from the Triassic, Jurassic and Rhætic of other regions. In the third he republishes Emmons' figures of the Mesozoic flora of N. Carolina, compares it with the Virginia flora, considers both floras as of the same age, and that age as not older than the rhætic.

S. W. Ford, in the *Amer. Journ. Sci. and Arts* for July, has a "Note on the discovery of Primordial fossils in the town of Stuyvesant, Columbia county, N. York."

James Hall has published another abstract of a paper to be issued in the 35th museum report of the State of N. Y., containing descriptions of the species of fossil reticulate sponges, constituting the family Dictyospongidae; the plates were published before with the title, "Notes on the family Dictyospongiæ." An abstract of this article appeared in the *Geological Magazine* for December. The same number of the *Geological Magazine* contains an abstract of a paper "On the Lamellibranchiate fauna of the Upper Helderberg, Hamilton, Portage, Chemung and Catskill groups (equivalent to the Lower, Middle and Upper Devonian of Europe); with especial reference to the arrangement of the Monomyaria and the development and distribution of the species of the genus *Leptodesma*."

G. Hambach, in the *Trans. Acad. Sci. St. Louis*, Vol. iv, No. 3, has "Notes about the structure and classification of the Penremites. In the same volume he has also an article describing some "New Palæozoic Echinodermata."

Angelo Heilprin has published "North American Tertiary Ostreidae" as an appendix to Dr. White's review of the fossil Ostreidae. He describes a Carboniferous Ammonite from Texas in the *Proc. Acad. Nat. Sci. Philadelphia*. He has also published a collection of his works on the Tertiary, under the title "Contributions to the Tertiary geology and palæontology of the United States."

Alpheus Hyatt, in *Science*, Vol. III, has an article on the "Evolution of the Cephalopoda." In the *AMER. NATURALIST* for September he has a note on the "Protoconch of Cephalopoda." In the *Proc. Boston Soc. Nat. Hist.* he places a paper, preliminary to a monograph which will appear in the memoirs of the Museum of Comp. Zoology, on the "Genera of fossil Cephalopods." In the *Proc. of the Amer. Assoc. for the Adv. of Sci.*, August, 1883, he has a paper on the "Fossil Cephalopoda in the Museum of Comparative Zoology," containing a discussion of the relations of this group.

J. F. James, in *Science*, Vol. III, criticises two of the determinations made by Leo Lesquereux in his Tertiary flora U. S. Geol. and Geog. Surv. Terr., F. V. Hayden. [This work although printed has not yet been distributed.] He also has an article on

"The Fucoids of the Cincinnati group," in the Journ. Cincinnati Soc. Nat. Hist., Vol. VII.

U. P. James, in the Journ. Cincinnati Soc. Nat. Hist., Vol. VII, publishes three articles; in the April number he describes three fossils from the Cincinnati group. In the October number he describes four new species of fossils from the Cincinnati group; and in the same number he has also an article "On Conodonts and fossil annelid jaws."

T. R. Jones and J. W. Kirby, in the *Geological Magazine* for August, have descriptions and notes "On some Carboniferous Entomostraca from Nova Scotia."

Leo Lesquereux, in the 2d Geol. Surv. Pennsylvania, Rep. Progress P., Vol. III, finishes his description of the coal flora of the Carboniferous formation in Pennsylvania and throughout the United States. This contains also additions and corrections to the first two parts previously published.

In the 13th annual report of the Indiana Department of Geology and Natural History, the same author publishes "Principles of Palæozoic Botany," an excellent elementary treatise. The Indiana Geol. Surv. has done excellent work in the way of popular instruction, and it is to be hoped that its labors will not be permanently discontinued. In the AMERICAN NATURALIST for September the author has an article on "The Carboniferous flora of Rhode Island."

J. B. Marcou, in the AMERICAN NATURALIST for April, published a review of the progress of North American invertebrate palæontology for 1883.

G. F. Matthew has two short abstracts of articles in the *Geological Magazine* for October: "The primitive Conocorypcean," and "The geological age of the Acadian fauna." In the Trans. Royal Soc. of Canada, Vol. I, the same author has "Illustrations of the fauna of the St. John group, No. 1, The Paradoxides," and a supplementary section describing the parts of the previously described species.

John Mickleborough, in the *Geological Magazine* for February, republishes his article on the "Locomotory appendages of Trilobites" (see last year's review).

S. A. Miller published a "Description of a beautiful star-fish and other fossils" from the Cincinnati group in the April number of the Journ. Cincinnati Soc. Nat. Hist.

Otto Myer, in the Proc. Acad. Nat. Sci., Philadelphia, published "Notes on Tertiary shells." In these notes he proposes the n. g. *Tibiella*, but gives no synopsis of generic characters.

M. Neumayr, in the Neu. Jahrb. für Min., Geol. und Pal., Stuttgart, notes the parallel position occupied by the Laramie group in N. W. America, and the Intertrappean beds of the Deccan in Hindostan.

E. N. S. Ringueberg, in the Proc. Acad. Nat. Sci. Philadelphia, has descriptions of "New fossils from the four groups of the Niagara period of Western New York."

S. H. Scudder, in the *Amer. Journ. Sci. and Arts* for September, has an article on Triassic insects from the Rocky mountains. Mr. Scudder identifies these beds as belonging to the Triassic period, according to their insect fauna. Mr. Lesquereux considers that their flora shows them to be of Permian age. In the Mem. Boston Soc. Nat. Hist., Vol. III, he has an article on "Two new and diverse types of Carboniferous myriapods," and in the same publication he has also "The species of *Mylacris*, a Carboniferous genus of cockroaches." In the Proc. Amer. Acad. Arts and Sci. Boston, the same author has two articles, one "A contribution to our knowledge of Palæozoic Arachnida;" the other on "Dictyoneura and the allied insects of the Carboniferous epoch." This last is a brief paper published in advance of a fuller memoir with detailed descriptions and full illustrations.

J. W. Spencer, in the Bull. Museum of the University of the State of Missouri, publishes an article on "Niagara fossils," which will be reproduced also in the Proc. St. Louis Acad. Sci., Vol. IV, No. 4. The illustrations are so bad and the species in some instances, e. g., *Cyrtoceras reversum*, founded apparently on such poor specimens that it will be very difficult if not impossible for future workers to recognize Mr. Spencer's types.

Frank Springer, in the *Amer. Journ. Sci. and Arts* for February, has an article "On the occurrence of the Lower Burlington limestone in New Mexico.

E. O. Ulrich, in the Journ. Cincinnati Soc. Nat. Hist., December, 1883, continues his descriptions of N. American Palæozoic Bryozoa.

C. D. Walcott has published his "Palæontology of the Eureka district," being Vol. VIII of the monographs of the U. S. Geological Survey. The discussion of the development of *Olenellus*

howelli is very interesting. The discovery in the Devonian of the interior of a dorsal valve of *Lingula whitei* proves the great similarity of structure between the Lingulæ of the Silurian, Devonian and recent time. A commingling of Upper Devonian and Lower Carboniferous fossils occurs; there occurs also a gradual transition from the beds containing *Olenellus howelli* through beds containing a fauna similar to the Potsdam of New York, to beds containing a fauna comparable to that of the chazy and calciferous groups. The transition is very gradual, and such as would occur where there had been no marked physical disturbance. In the Bull. U. S. Geological Survey the same author has "Preliminary studies on the Cambrian faunas of N. America." These are in three parts, the first is "A review of the fauna of the St. John formation, contained in the Hartt collection." This work is not meant to encroach on that of Mr. Matthew. Mr. Walcott does not accept the genus *Conocephalites*, and refers its different species to *Ptychoparia* and one of *Conocoryphe*. The second part is on the "Fauna of the Braintree Argillites." The third part contains the description of a new genus and species of *Phyllopora* from the Middle Cambrian slates of Parker's farm, Georgia, Vermont. In *Science*, Vol. III, the same author has an article on the "Appendages of the Trilobite;" he notes the verification of the hypothesis that the legs were jointed beneath the pygidium as the only addition to our knowledge furnished by Mr. Mickleborough's specimen.

Lester F. Ward, in the *Amer. Jour. of Sci. and Arts*, has an article "On Mesozoic Dicotyledons."

C. A. White, in the Rep. of the Secretary of the Interior for 1883, Vol. III, gives "A review of the fossil *Ostreidæ*, North America, and a comparison of the fossil with the living forms. With appendices by Professor Angelo Heilprin and Mr. John A. Ryder." This work is on the same plan as that followed in the review of the non-marine fossil Mollusca published the year previous. In the Bull. of the U. S. Geological Survey, No. 4, the author has three articles, the first, "On a small collection of Mesozoic fossils collected in Alaska, by Mr. W. H. Dall, of the U. S. Coast Survey." The author considers these forms to belong to beds occupying a transitional position between Cretaceous and Jurassic, as previously suggested by Professor J. Marcou. The second is a "Description of certain aberrant forms of the Cham-

dæ from the Cretaceous rocks of Texas." And the third is "On the nautiloid genus *Enclimatoceras* Hyatt, and a description of the type species." In Vol. VI of the Proc. of the U. S. National Museum he has an article "On the *Macrocheilus* of Phillips, *Plectostylus* of Conrad, and *Soleniscus* of Meek and Worthen. In *Science*, Vol. III, he has a note on the "Enemies and parasites of the oyster, past and present." In the 13th annual report of the Indiana Department of Geol. and Nat. Hist., the same author has "The fossils of the Indiana rocks, No. 3." In this work he gives excellent illustrated descriptions of the characteristic invertebrate animal remains of the Carboniferous period.

J. F. Whiteaves, in the Geol. and Nat. Hist. Surv. of Canada, has Part III of his Mesozoic fossils, "On the fossils of the coal-bearing deposits of the Queen Charlotte islands collected by Dr. G. M. Dawson in 1878. The author is driven by his conclusions to assert that the Jurassic of the Black hills and Rocky mountains is Cretaceous. This assertion is far from being justified by the facts which the author adduces for its support. He has also Part I of Vol. III of "Palæozoic fossils." In the Trans. Royal Soc. Canada, he has an article on the "Lower Cretaceous rocks of British Columbia." In this article he holds that the presence of an abundance of *Ancellæ* is a sure proof of the Neocomian age of the rocks in which they occur. In the same publication he has also an article "On some supposed Annelid tracts from the Gaspé sandstones."

R. P. Whitfield, in the Bull. Amer. Museum Nat. Hist. Vol. I, No. 5, has a "Notice of some new species of primordial fossils in the collections of the museum, and corrections of previously described species." He thinks that the difference in faunas between the different Cambrian areas is more the result of the conditions upon which life depended than a difference in time.

H. S. Williams, in the Bull. U. S. Geol. Surv., Vol. No. 3, has an article "On the fossil faunas of the Upper Devonian along the meridian 76° 30' from Tompkins county, New York, to Bradford county, Pennsylvania." The paper is the first of a series. In *Science*, Vol. III, he has an article on "The Spirifers of the Upper Devonian."

H. Woodward, in the *Geological Magazine* for February and for April, has two articles, one is "On the structure of Trilobites." This is a reproduction of the author's views on the ap-

pendages of trilobites, and in particular of *Asaphus platycephalus* Stokes, as published by him in 1871. The other bears the title, "Notes on the appendages of Trilobites. Note to accompany three woodcuts of *Asaphus megistos*, a trilobite discovered by Mr. James Pugh, near Oxford, Ohio, in the upper portion of the Hudson River group." The figures are a reproduction of Mr. Mickleborough's.

A. H. Worthen, in Bull. No. 2 of the Illinois State Museum Nat. Hist., publishes descriptions of two new species of Crustacea, fifty-one species of Mollusca and three species of Crinoids from the Carboniferous formation of Illinois and adjacent States. No illustrations whatever accompany these numerous descriptions.

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THE CLAM-WORM.

BY SAMUEL LOCKWOOD, PH.D.

WALKING at low tide on the wet flats of the New Jersey shore, the stranger is surprised by little spurts of water suddenly springing from the sand. These jets reveal the hiding places of the soft clam, or "nanny nose," a corruption of the Indian name "maninose." This discharge of water at the approach of footsteps, thus betraying its retreat, is an act which the mollusk cannot help. The home of the bivalve is often many inches deep in the sand, but the extensile siphon must reach the surface. Alarmed at the tremor of the sand caused by the approaching steps, this organ is so rapidly withdrawn, even down into the valves at the bottom of the perpendicular burrow, that the sudden collapse expels the water with which the siphon and other cavities of the body are filled. Without such result the rapid retreat of the siphon from harm's way would be impossible. After one of these squirts I have dug fully fourteen inches deep, and found the clam with all its parts snugly tucked within its two valves.

The water ejected as described is simply the fluid which was taken in before the tide went out. If the observer will be quiet and keep motionless for a few minutes the clam may soon regain its confidence, and the tip of the siphon, with its two pretty orifices—the inlet and the outlet, again appear at the little hole in the sand. Now let one's foot be moved, and again the siphon is

instantly withdrawn; but there is no spurt as before, because the previous effort had emptied it of water.

The systematists call our mollusk *Mya arenaria*, but in popular speech, because of its siphon, it is sometimes known as the stem-clam, and to distinguish it from *Venus mercenaria*, the quahog, round-clam or hard-clam, it is often called the soft-clam and long-clam.

Busily delving with short-handled hoes, men and boys may be seen, at low tide, all over these sandy flats. They are "the clam-mers." Long practice, with perhaps inherited instinct, has made these persons expert in detecting the signs of the places of these mollusks, even when not betrayed in the usual way. They certainly have that fine eye for discernment which comes of being to the business "bred and born." Though perhaps preferring such places, these soft-clams are not limited to the sandy flats. They are also found in gravelly and even muddy beds.

In digging the clammer brings to the surface many a fine invertebrate of much interest to the naturalist. Among these quite often is a gayly tinted annelid, a quasi-aquatic myriopod. We watched one of these delvers, a youth quite bright in his own way, and respectful too, except perhaps to some student pedant whom he cannot understand, and whom he seems to regard as a "dude in larning," as we found out a little to our cost. There! He turns up an annelid now, and we exclaim—"What a pretty Nereid!" To which, with a quizzical cast of the eyes, he responds: "Nary time, Mister! That's only a clam-worrum!" Glad to become a learner upon opportunity, we ask why it is called a clam-worm. The answer, now politely given, is: "Because its gin'allly found along with the clam. Most like it's clam-feed, or something in that way."

The best known of these Nereids in our Eastern waters are *N. limbata*, *N. virens* and *N. pelagica*; of these three the chances are many that the Jersey clammers' acquaintance will be restricted to the first one mentioned, though all would be the same to him. And it must be known that though called a clam-worm, Nereis is no pariah, but the very highest in its class, the Annelides. And *N. limbata* is sometimes found seeking the higher society of the marine invertebrates. Verrill says of this species: "Both males and females were often found among the barnacles and ascidians on the piles of the wharves at Wood's Holl, but the males were

the most abundant, while the reverse was the case with those dug out of the sand and gravel at the shores." The same author tells of their habitats in shelly and gravelly beds, and even of their floating in great numbers at the surface of the water. This statement recalls a thrilling experience of our own many years ago inside of Sandy Hook. All told we numbered three, in a sailboat, and our one object, squidding for blue-fish, the gamey *Pomatomus saltatrix*. The wind was so stiff that we had enough on our hands to take care of ourselves and our little craft. It was a very warm day in August, and to my astonishment we went through a floating bank of these clam-worms. They lay close together, and the float seemed several hundred feet long, and owing to the high wind it was disposed in concentric drifts, or wind-rows. Our game was up, touch our squids *Pomatomus* would not—he had come to a banquet worthy of the gods—I cannot affirm whether the banquet had attracted them, but just after the Nereid course was finished, a school of Menhaden appeared. The blue-fish went for them, and the scene was simply pitiful. In their frantic efforts to escape, the poor things piled themselves one upon another, and the jaws of the terrible blue-fish, like a thousand shears, cut into them, while the air was alive with gulls screaming in delight over the carnage, as they were continually pouncing upon the floating fragments of the gory feast. As the Nereids deposit their eggs near shore, and as this scene was witnessed inside of Sandy Hook bay, a good place for their breeding, and as my memory serves, the worms were small, it has seemed to me that they were young individuals.

Wishing to resume study of the Actiniæ, I procured from Fall river some specimens of *Metridium marginatum*, with a quantity of the green sea-lettuce, *Ulva latissima*, among which was one tuft of the succulent red alga, *Rhabdonia tenera*. The plants soon took on a fine growth. I became annoyed, however, at the unsightly appearance of ragged holes in the green fronds, and their number steadily increasing. Soon the depredator was detected at work in a thick bunch of *Ulva*. The red alga was not touched. This annelid browsing was an interesting sight. For every one of its many segments was a pair of parapoda, or side paddles, with which, though the action seemed serpentine, it moved about a plant as easily as a bird around an evergreen when seeking insects on the tree. And what a pair of jaws, each

with a row of small sharp teeth on the curve of the inner side, as if two tiny sickles could be converted into saws. The little beast was slashing remorselessly into these translucent delicate sheets of emerald gelatine. I said jaws. The whole apparatus has been called a proboscis—but such an exceptional one! The annelid in repose carries his jaws down his throat just over the œsophagus, and when he eats the two serrate sickle jaws are everted, that is, protruded, pharynx and all. This creature was our clam-worm, *Nereis limbata*. It moves in graceful ease through the marine meadows by means of its two long rows of parapoda, or natural oars. It has four eyes, and they see me too, for it disappears instantly. Its retreat is a little burrow in the sand, a transverse section of which would be nearly oval. The books say that the *Nereis* secretes a viscid fluid with which it lines its burrow. Its progress in this retreat is rapid, and it can move either way with equal ease. Its head is now at the entrance, hence it has turned in its burrow, and as this is pretty well filled by the worm's body, how does it double on itself? It has such a knowing look with its four optics, and four pairs of feelers, as if in its tentacular wisdom it were inspecting every object anent the cabin door. And then it has an amiable look, for that proboscis with its formidable jaws is concealed down the throat.

I found two others in the tank. Each was from two and a half to three inches long. Twice one of them was so accommodating as to make its burrow against the glass side of the tank. I now watched the movement in the burrow and saw how easily it could advance or recede; but I failed to see the doubling on itself. And then it was pretty to note that the paddle-like rami were never soiled.

How could I grudge my Nereids their inroads on the lettuce beds, as I deemed them vegetarians of the Simon-pure variety? I was feeding the Actiniæ with small pellets of raw beef. It occurred to me to tempt the Nereid from its simple fare with a stronger diet; so I dropped a bit of beef at the entrance to the burrow. The tentacular wisdom made a snap judgment—"fresh beef is good," for out popped the proboscis, that is, the pharynx and its formidable jaws, and the welcome morsel was hooked with a jerk into the burrow. How deceptive are appearances. Vegetarian indeed! My Nereids are rabid carnivores. Thence on I fed the Nereids beef whenever I fed the Actiniæ.

To the naturalist who uses the microscope, an old marine aquarium is fruitful of interesting minute forms of life, both plants and animals. This is certainly true of the micro-algæ. I observed one day what seemed to me a new form of algæ, little clusters of a deep orange color on the sandy floor of the aquarium. Each bunch was hardly more than an eighth of an inch in diameter. Some of the little cylinders of which a cluster was composed were put under the microscope. There was not the slightest appearance of any cell structure, nor even the presence of any distinct protoplasm. They were granular in composition, but there was no sac or case. They had something of the look, size excepted, of the casts in Bright's disease. These little tufts of tiny orange-colored cylinders kept on increasing. When two or three days old they turned white. I noticed that they were all in proximity to the burrows of the Nereids. They proved to be their excreta—enteric casts of their imperfectly digested food. That deep dull orange was still a puzzle, for when freshly cast these excreta were exactly the color of the calcareous crust which covers the horny axis of some of the sea-fans, Gorgonia. It was noticeable that since the beef diet had been begun, the Ulva was let entirely alone.

But there arose a famine in the land. No *fresh* beef could be got. Of course the Nereids could go back to the sea-lettuce, but they chose to let it alone. From "pickings" they turned to "leavings," or perhaps more correctly from "primes" to "middlings." Thanks to the gentle Cowper whose Task supplies the word befitting ears polite—every "stercoraceous heap" was soon eaten up! Our pretty Nereis, then, has a threefold appetency—since it is by turns a vegetarian, a carnivore, and even an auto-stercophaga! an eater of its own casts.

But such things are found in higher quarters. Dr. Rau, in his translation of the Jesuit Baegert, says of certain California tribes now extinct, that in its season they almost lived upon the fruit of the pitahaya, and when that gave out they were reduced to short rations. Says the missionary :

"In describing the pitahayas I have already stated that they contain a great many small seeds resembling grains of powder. For some reason unknown to me these seeds are not consumed in the stomach, but pass off in an undigested state, and in order to save them the natives collect during the season of the pitahayas that

which is discharged from the human body, separate the seeds from it, and roast, grind and eat them, making merry over their loathsome meals, which the Spaniards therefore call the second harvest of the Californians." See Smithsonian Report, 1865, p. 365. Baegert's book was published at Mannheim, 1773.

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LIFE AND NATURE IN SOUTHERN LABRADOR.

BY A. S. PACKARD.

(Continued from p. 275 March number.)

AFTER roaming over the island and making pretty full collections of the insects, we paid attention to the marine zoölogy. Shore collecting is not as remunerative in Labrador as on the Maine and Massachusetts coasts. The most noticeable form is the six-rayed starfish (*Asteracanthion polaris*) which sometimes measured twenty inches from tip to tip of its opposing rays; its color was a dirty yellowish white, not red as in the common fire-finger, also abundant. The polar starfish is common in Greenland, and is a truly arctic form.

The common crab (*Cancer irrorata*) frequently occurred under stones, but the lobster was neither seen nor heard of; though common on the southern shores of Newfoundland it does not reach north into the Straits of Belle Isle. Among the worms which occurred at low water mark was the Pectinaria. On the New England coast it only occurs in deep water below tide mark.

Dredgings were first made at the mouth of Salmon river, a few rods from shore, in some eight fathoms of water in a firm deep mud. The most characteristic shells were gigantic *Aphrodite greenlandica*, large cockles (*Cardium islandicum*), as well as the pelican's foot (*Aporrhais occidentalis*), which occurred of good size and in profusion. In the soft mud occurred multitudes of the neat little sand star (*Ophioglypha nodosa*). Another form dredged on rocky bottom was *Cynthia pyriformis*, or the sea peach, and large specimens were cast up by the waves on the beach. Every spare day was given to dredging, and having been deeply interested in marine zoölogy by the writings of Gosse, in England, and of Stimpson in this country, and having obtained a good idea of the local marine fauna of Casco bay, in Maine, it was with no little interest and expectation that we dropped the

dredge in arctic waters, and we were not a little delighted with the result of finding so near shore and in such shallow water, forms which off the coast of Maine, in deep water, were rare and usually but half grown.

July 25th a party of us rowed up Salmon bay and went a mile up the river. The tide was out and we looked for the fresh-water mussel (*Alasmodon arcuata*), which is our northernmost species, and inhabits the rivers of Southern Newfoundland. We could find none, although the settlers told us that mussels, clams and "oysters" were common enough in the river. But something better was discovered. We found traces of genuine Quaternary marine sands and clays containing fossils. There were several banks of sand and clay along the edges of the river. In the latter I found *Aphrodite greenlandica* and *Aporrhais occidentalis*, with *Buccinum undatum*. They had been washed out of the clay into the bed of the river, and were collected at low water. I also dug several inches into the clay bank and found the disintegrated shells of the *Aphrodite*, so as to leave no doubt but that the shells were fossils. Down at the mouth of the stream at the head of the bay, on the flats, I found several *Buccinum undatum*, and quite a number of *Aporrhais*, young and old, broken and entire. On each side of the river was a terrace of sand and clay, with a thick growth of alders and willows, with the fire-weed (*Epilobium angustifolium*), the golden rod and a large cruciferous plant common in the mountainous parts of New England; also *Comarum palustre*, and a *Thalictrum*. Farther back and mostly lining the banks was a dense growth, impossible to penetrate save occasionally where there was a break in the thicket of spruce and a birch, perhaps *Betula populifolia*. Still farther up and away back stretched the bare moss-covered hill tops, the summer resort of deer and caribou. Here we saw a ptarmigan. But this was one of our halcyon days, of which there were few, as the last two weeks of July were stormy and wet. The clear fair-weather winds were from the south-west; the south-east winds brought in the fog and rain, while the northerly winds brought a few curlew, the advance guard of the hosts which were to arrive early in August.

The 3d of August was a fine day. A party of us went up the Esquimaux river to Mrs. Chevalier's, whose husband, now dead, entertained Audubon when visiting this coast. The sail up the

river was a pleasant one. It was about three miles from its mouth to an expansion of the river, on whose shores were four or five winter houses. Although most of the settlers live on the coast through the year, some have their winter and summer houses. Those who live up the interior, sometimes a distance of seventy miles from the coast, where there is wood and game, move from the shore about the 20th of October. They spend a month in cutting wood, a family burning through the winter about thirty cords. Then succeeds a month of hunting and trapping. The snow does not come, we were told, until the last of December, although we should judge this to be an extreme statement, and the snow is not usually more than three feet deep. The people profess to like the winter better than the summer. They shoot deer, foxes, &c., black fox being sometimes secured, whose skin is worth between two and three hundred dollars. Grouse are abundant, a good hunter securing from sixty to seventy a day in favorable seasons. At any rate fresh meat is obtained for each family two or three times a week.

The houses are small, built of wood, boarded and shingled, seldom constructed of logs, and are heated by peculiar stoves, great square structures resembling Dutch stoves, and heating the whole house, the two living rooms opening into each other, the stove being placed partly in each.

The French residents at the Mecatina islands, more social and gayer than the phlegmatic English settlers about the mouth of the Esquimaux and Salmon rivers, spend the winter evening in dancing and other gayeties to which the Anglo-Saxon, in Labrador at least, is a comparative stranger.

The Esquimaux river at its eastern entrance is but a few rods wide. Passing Esquimaux island we sailed out into a broad bay or expansion of the river, with ravines leading down to it, and under the steep bank protected from the northerly winds were the winter houses previously described. Up the river, just beyond Mrs. Chevalier's, the river contracted into narrows with rapids; it then opened into another bay or expansion two miles wide, the river being a succession of lakes connected by rapids, and this is typical of the rivers and streams of the Labrador peninsula. A barge cannot sail up the Esquimaux river more than fifteen miles, although one can push farther on in a flat boat. We were told that the river is about two hundred miles in length, and although perhaps the largest in Labrador it has never been explored.

Here we met the black flies in full force, and although we had been fearfully annoyed by them in rambling over Caribou island, here they were astounding, both for numbers and voracity. The black fly lives during its early stages in running water. The insect finds nowhere in the world such favorable conditions for its increase as in Labrador, over a third of whose surface is given up to ponds and streams. The insides of the windows of Mrs. Chevalier's house swarmed with these fiends, the children's faces and necks were exanthematous with their bites; the very dogs, great shaggy Newfoundlanders, would run howling into the water and lie down out of their reach, only their noses above the surface. The armies of black flies were supported by light brigades of mosquitoes. No wonder that these entomological pests are a perfect barrier to inland travel; that few people live during summer away from the sweep of the high winds and dwell on the exposed shores of the coast to escape these torments. They are effectual estoppers to inland exploration and settlement.

Accepting our hostess' kind invitation to take dinner, we sat down to a characteristic Labrador midday meal of dough balls swimming in a deep pot of grease with lumps of salt pork, without even potatoes or any dessert; nor did there seem to be any fresh fish. The staples are bread and salt pork; the luxuries game and fish; the delicacies an occasional mess of potatoes, brought down the St. Lawrence once a year in Fortin's trading schooner.

Over the mantelpiece was a stuffed Canada grouse or partridge and a ptarmigan in its winter plumage, but I was most delighted with the gift of some Quaternary fossils with which Mrs. Chevalier kindly presented me, including large specimens of *Cardia borealis*, *Aporrhais occidentalis* and, most valuable of all, the valves of a brachiopod shell, which I had also dredged on the coast in ten fathoms, the *Hypothyris psittacea*. On our return down the river we fished up the valves of the *Pecten magellanicus*, the great scallop shell, which lives in five or six feet of water. This mollusk, which is locally known in Labrador by the name of "pussel," we afterwards obtained in quantity, fried it in butter and meal, finding it to be delicious eating, combining the properties of the clam and oyster, the single large adductor muscle being far more tender than that of the common scallop of Southern New England and New York.

With our man, James Mosier, and his sailboat we spent two days in dredging in from forty to fifty fathoms out in the Straits of Belle Isle, three or four miles from land. The collection was a valuable one, containing some new species. The crown of the bank which we raked with our poorly constructed dredge was packed with starfish, polyzoans, ascidians, shells, worms and Crustacea. The collection was purely arctic, and had not the only dredge I had become broken, we should have reaped, or rather dredged, a rich harvest. As it was, the novelties were quite numerous, and the interest and excitement, as well as labor, of overhauling, sorting and preserving what we did obtain lasted for several days.

The only plant besides stony vegetable growths called "nullipores" dredged at this depth was a delicate red sea-weed, the *Psilota elegans*, which was found afterwards to extend as far down in depth as ninety fathoms. Those who glibly talk, on *terra firma*, of plant life as affording a basis for animal life, should dredge in deep water. They will find that a vast population of animals of all sorts and conditions in the scale of life is spread at all depths over the sea bottom, thriving almost without exception on one another—on animal protoplasm—and in the beginning of creation animal life was without doubt contemporaneous in appearance with vegetable existence. Indeed, what is the difference in form and structure between a bacterium and a moner? The two worlds of plant and animal life arise from the same base, a common foundation of simplest structure, showing none of the distinctive characteristics of animal or plant life, and only barely earning the right to be called organisms, that vague term we apply for convenience to any, even the simplest structures endowed with life.

Of all the pleasures of a naturalist's existence, dredging has been, to our mind, the most intense. The severe exertion, the swimming brain, the qualms of sea sickness, tired arms and a broken back, the memory of all these fade away at the sight of the new world of life, or at least the samples of such a world, which lie wriggling and sprawling on the deck of the sailboat, or sink out of sight in the mud and ooze of the dredge, to be brought to light by vigorous dashes of water drawn in over the side of the boat. Those days of dredging on the Labrador coast, where there was such an abundance and luxuriance of

arctic varieties, were days never to be forgotten. There is a nameless charm, to our mind, in everything pertaining to the far north, the arctic world, and we can easily appreciate the fascination which leads one back again to the polar regions, even if hunger and frost had once threatened life. Arctic exploration has but begun, and though its victims will yet be numbered by the score, enthusiasts will yet attempt the dangers of arctic navigation, and fresh trophies will yet be won.

Early in August, during the few still clear nights succeeding bright and pleasant days, we had auroras of wondrous beauty, not excelled by any depicted by arctic voyagers.

On the 10th of August the curlews appeared in great numbers. On that day we saw a flock which must have been a mile long and nearly as broad; there must have been in that flock four or five thousand! The sum total of their notes sounded at times like the wind whistling through the ropes of a thousand-ton vessel; at others the sound seemed like the jingling of multitudes of sleigh bells. The flock soon after appearing would subdivide into squadrons and smaller assemblies, scattering over the island and feeding on the curlew berries now ripe. The small snipe-like birds also appeared in flocks. The cloud berry was now ripe and supplied dainty tid-bits to these birds.

By the 18th of the month the golden rods were in flower. Here, as has been noticed in arctic regions, few bees and wasps visit the flowers; the great majority of insect visitors are flies (Muscidæ), especially the flesh fly and allied forms. A bumble-bee occasionally presents himself, more rarely a wasp, with an occasional ichneumon fly, but the two-winged flies, and those of not many species, were constant visitors to the August flowers. The black flies still remained to this date terrible scourges in calm weather, though in cloudy days and at night they mostly disappeared.

Wandering through the fog and drizzle along the mud flats on the northern side of the island I picked up *Aporrhais occidentalis*, *Fusus tornatus*, *Cardita borealis*, large valves of *Saxicava rugosa*, *Buccinum* and *Astarte sulcata* and *compressa*; these and *Pecten islandicus* and other shells forming much the same assemblage as I had dredged a few days previous out in the straits in fifty fathoms. The only recent shells lying about were shallow-water forms, such as the common clam, *Tellina fusca* and the razor

shell. It was evident that here was a raised sea-bottom, and the Quaternary formation. In the afternoon I returned to the spot and dug up many more shells mingled with pieces of a yellow limestone containing Silurian fossils, brachiopods and corals. This horizon, then, represented a deep sea-bottom, over which the open sea must have stood at least 300 feet, while the clay fossils of the mouth of the Esquimaux river must have lived in a deep muddy bay sheltered from the waves and currents of the open sea. The drift deposits of Labrador are scanty in extent compared with those of the Maine coast. They are but isolated patches compared with the extensive beds of sand and clay which compose the Quaternary deposits of New England.

On the 22d August we made our last excursion up the Esquimaux river, going up some six miles from its mouth. From a hill top I could look over the surface of this lake-dotted land. The surface was rugged and bare in the extreme. The river valley, however, was well wooded, the spruce and birch perhaps thirty feet in height. Here and there the river passed through high precipitous banks of sand. The hills were rough, scarred with ravines, precipices, and deep gaps, the syenite wearing into irregularly hummocky hills, the rough places not filled up with drift, and thus the contours tamed down as in New England. Indeed, Labrador at the present day is like New England at the close of the ice period or at the beginning of the epoch of great rivers, before the terraces were laid down and the country adapted for man's residence. Labrador was never adapted for any except scattered nomad tribes. It is still an unfinished land.

While the hills were bare and the rocks covered with the reindeer moss, here and there by the river's edge in favorable, protected places were tall alders and willows, with groups of asters and golden rods. Here I saw a veritable toad, and glad enough was I to recognize his lineaments. I was also told that there were frogs in existence, though we never saw or heard them. There are no snakes or lizards, so that our history of these animals in Labrador will be as brief as that of the Irish historian, but we did find a small salamander at Belles Amours in a later trip to this coast.

On our return we found that a whaler had towed a whale into the mouth of the river and was about to try out the oil. We secured a piece of the flesh, and on reaching camp boiled it; it

was not bad eating, tasting like coarse beef. Seal's flippers we also found not to be distasteful, though never to be regarded as a delicacy.

Dredging and collecting insects on fine days when not too calm filled up the measure of our seven weeks. The time passed rapidly, the days were too short for all the work we planned to do, and it was not without regret that we left the rugged untamed shores of the Labrador. On the afternoon of the very day she had set for her return to Caribou island, the *Nautilus* hove in sight. As she made our harbor she struck upon a sunken rock, tore off a piece of her keel, but slid off and came to anchor as near as practicable to the mission house, and then succeeded the mutual spinning of Labrador and Greenland yarns by the reunited party.

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RECENT LITERATURE.

COPE'S VERTEBRATA OF THE TERTIARY FORMATIONS OF THE WEST.¹—Just ten years ago (1875) a bulky quarto volume on the Vertebrata of the Cretaceous formation of the West, by Professor Cope, appeared, forming the second volume of the memoirs of the Hayden Geological Survey of the Territories. The ponderous volume now before us contains between three and four times as many pages and about fifty more plates. The work is designed to present figures and descriptions of the vast number of species of vertebrates of all classes, but more especially of the mammals of the Tertiary lake-basins of the West. For the first time the palæontologist has before him the materials for a view of that rich fauna which through the Tertiary period crowded the shores of the immense lakes whose sediments form the surface of our Western plains—a fauna whose descendants, vastly less in number though more highly specialized, still survive on this continent.

The subject is naturally the most attractive the palæontologist could have presented to him, since the materials represent a number of extinct orders, suborders and families, which fill more or less completely the wide gaps between the existing orders of mammals, and enable the student to examine the foundations, so to speak, upon which the existing groups have been built up; this, of course, has led not only to the solution of knotty points in classification, but to broader conceptions of the relations of the

¹ *U. S. Geological Survey of the Territories.* F. V. Hayden in charge. The Vertebrata of the Tertiary formation of the West. Book I. By EDWARD D. COPE. Washington, 1883-4. 4to, pp. 1009, with over 100 plates and numerous wood-cuts in the text.

extinct to the living groups, their genealogy, and finally the origin of the class itself from the lower vertebrates.

The points of special value to palæontology and bearing on the doctrine of evolution, worked out by Professor Cope in this volume, are quoted from Professor Hayden's letter of transmission to the Secretary of the Interior:

"1. The discovery of the fauna of the Puerco group, of thirty genera and sixty-three species. This includes many important details, such as the discovery and definition of three new families with many species of a new order, the Taxeopoda, as the Peripitychidæ, Meniscotheriidæ, and a new suborder, the Taligrada, represented by the genus Pantolambda; also the discovery of the Plagiaulax type (of the Jurassic) and other marsupials, and the Laramie saurian genus Champsosaurus in the Puerco group.

"2. The new classification of the Ungulata rendered possible by the discovery of the complete remains of the Wasatch types of Phenacodus and Coryphodon, especially the former, from Wyoming Territory. The light thrown on the phylogeny of the Ungulata by this discovery exceeds that derived from all other sources together.

"3. The new classification of the lower clawed mammals, based on the analyses of fifteen new genera and forty-seven new species of flesh-eaters and six new genera and sixteen new species of allied forms, all discovered since the publication of the author's volume in connection with the Wheeler survey.

"4. The restoration of Hyracotherium, the four-toed horse of the Wasatch group.

"5. The restoration of the genera Triplopus and Hyrachyus of the Bridger fauna.

"6. The determination of the systematic relation of the Dinocerata as seen in the genera Loxolophodon and Bathypsis.

"The whole number of genera described in this volume is 125 and of species 349, of which 317 species were determined by Professor Cope.

"The explorations that furnished the materials for these volumes began in 1872 and are still being continued. It will therefore be readily seen that the amount of new matter towards the origin and history of the Mammalian group, brought together by the author in these two volumes, is most extraordinary, and will probably never be surpassed."

The explorations for the fossils here described were made by the author largely at his own expense, and full acknowledgment is made of the services of those who made the collections when the author was not in the field, and of the preparator in the laboratory.

The volume lay for a year in the bindery, so that while printed in 1883 it was not bound until 1884, and was not distributed until February of the present year.

Some typographical errors are not corrected in the errata, this is probably due to the fact that the printing was done mostly during the summer while the author was in the field, while a large amount of proof was sent to Mexico and there lost.

The present volume is divided into two parts, Part I relating to the Puerco, Wasatch and Bridger faunæ (Eocene); and Part II comprising the White River and John Day faunæ, Lower and Middle Miocene. Vol. IV is in preparation and will comprise the Upper Miocene fauna (Ticholeptus and Loup Fork fauna) and the Pliocene.

The introduction is divided into two sections, in the first of which the character and distributions of the Tertiary formations of the central region of the United States are noticed. In the second section are discussed the horizontal relations of the North American Tertiaries with those of Europe.

Then follow the description of the fossils, beginning with the fishes and ending with the mammals.

The general conclusions as to affinities and phylogeny are appearing in the NATURALIST in a series of articles which began two years ago.

The work is richly illustrated, the details amply supplementing the descriptions. As the result of extended investigations by an experienced comparative anatomist and morphologist, as well as palæontologist, this and the preceding volumes mark an epoch in American palæontology. It is a monument of energy and devotion to science, signaling the triumphs of severe and trying physical labor in the field, as well as patient, comprehensive and searching work in the laboratory and study.

CLAUS' ELEMENTARY TEXT-BOOK OF ZOOLOGY.¹—The larger work of Professor Claus is the latest and most authoritative treatise on systematic zoölogy, having passed through four editions. This work, somewhat cut down in size, is the original of the present one. As it is, the first part is a bulky octavo, and, as when completed it will be in two volumes, the book will not be so easy of reference as if it formed a single volume. The book in its English dress is richly illustrated, the cuts, for the most part, carefully prepared, mostly selected by Dr. Claus himself. To the general part are devoted 179 pages; the usual subjects of organic and inorganic bodies, animals and plants, cells and tissues, correlation of organs, accounts of the different organs, intelligence and instinct, development and evolution receiving full and accurate treatment, though the author's style is at times heavy and prolix, the translators not always adding perspicuity or elegance to the cumbrous German expressions. For example, on

¹ *Elementary Text-book of Zoölogy*. General part and special part: Protozoa to Insecta. By DR. C. CLAUS. Translated and edited by ADAM SEDGWICK, with the assistance of F. G. HEATHCOTE. With 706 woodcuts. London, W. Swan Sonnenschein & Co., Paternoster square, 1884. 8vo, pp. 615.

p. 1 the ordinary student will stand aghast at the following sentence: "The matter of unorganized bodies (for instance of crystals) is in a state of stable equilibrium, while through the organized being a stream of matter takes place." Do not streams generally flow? The punctuation is also defective, and cases of tautology occur. Why at this date there should be any distinction, even if in words, expressed between sarcode and protoplasm we do not understand. On p. 21 we find the following sentences in the section on the difference between animals and plants: "In the place of muscles, which as a special tissue are absent in the lower animals, there is present an undifferentiated albuminous substance known as sarcode, the contractile matrix of the body. The viscous contents of vegetable cells, known as protoplasm, possesses likewise the power of contractility, and resembles sarcode in its most essential properties." There is vegetable and animal protoplasm, but why give different names to what is fundamentally the same substance? Throughout the succeeding pages the word protoplasm is used for the contents of animal cells, and we read no more of sarcode.

The translator has, on p. 70, referred to the "spiral thread" of an insect's trachea, sufficient liberty might have been taken with the original to have given the latest and most correct view as to the structure of the trachea and the mode of tracheal respiration, as worked out by Professor Macloskie; although it should be stated that his paper did not appear until May last (see this journal, XVIII, p. 567). The statement concerning and figures of the nervous system of the Echinoderms might have been modernized and made more complete in the light of the discoveries of the two Carpenters, Marshall and Jickeli. There is otherwise but slight occasion for fault-finding, as Claus is evidently a sound, cautious compiler, and we should expect any slight inaccuracies to have been corrected by the able translator.

Passing to the systematic part, under the Protozoa we notice that Bathybius is mentioned, though with doubt, while no reference whatever is made of Eozoön. As an appendix to the Protozoa is a section devoted to the Schizomycetidæ, "which approach more nearly to the Fungi," and with them are treated the Gregarinidæ. The sponges are associated with the Cœlenterates, a view not, we think, either true or conducive to clearness.

The second subgroup of Cœlenterates proper (the sponges forming subgroup 1) are called Cnidaria, and for Hydrozoa we find substituted the term Polypomedusæ; it should also be mentioned that the Anthozoa are placed lower than the Hydrozoa. Balanoglossus, the representative of the class Enteropneusta, is placed between the Echinoderms and worms.

We wish a figure of the adult of the singular worm Polygoridius had been given, though a good sketch of its larva appears, but the excellence of the majority of the figures and the judg-

ment shown in their selection are almost beyond criticism. Why the Gephyrea and the Hirudinea are placed above the more highly specialized Chætopod worms we do not understand. As also why the Phyllopods should be placed at the base of the Crustacea, below the Copepoda and barnacles. This classification has been strenuously advocated by Claus, but not, we suppose, generally accepted; the reasons militating against this view are many and urgent; the Branchipodidæ, with their stalked eyes and highly specialized bodies, appear to stand nearer the stalked-eyed Crustacea than any other Entomostraca; and to go directly from the root-barnacles to the Malacostraca is straining more than one point in taxonomy. In treating the trilobites no reference whatever is made to American work, especially that of Walcott, who has demonstrated that they had hard jointed limbs; Claus states the obsolete view that they were "soft and delicate."

Among the Myriopods Pauropus is assigned to the Polydesmidæ, when it certainly represents a distinct suborder if not order. The Physopoda or Thrips are regarded as a tribe of Pseudo-neuroptera, although embryology shows they are Hemiptera. The taxonomy of the Lepidoptera seems to us to be very objectionable and old-fashioned, while it is a comfort to see that the Hymenoptera are placed at the head of the insect series. We shall look with great interest to the appearance of the second, closing volume.

GOODALE'S PHYSIOLOGICAL BOTANY.¹—In the year 1879 Dr. Gray brought out the new (sixth) edition of his widely known and used Botanical Text-book. The new book covered much less ground than the older editions, being confined to the structural botany of the phanerogams. It was then announced that Dr. Goodale was to prepare a second volume to be devoted to physiological botany, Dr. Farlow a third devoted to cryptogamic botany, and that the series was to be completed by a fourth volume to include a sketch of the natural orders of phanerogams. After waiting six years we have the pleasure of perusing advance sheets of the long-promised Vol. II. The part before us is devoted to the histology of the phanerogams, and is soon to be followed by Part II, which is to deal with vegetable physiology.

Upon opening the book we have first an interesting chapter devoted to histological appliances; a most useful chapter indeed it will prove to all workers in the botanical laboratory. In this we observe with pleasure the remark that "other things being equal, a microscope with a short tube and with a low stand will be most convenient on account of the large number of cases in which

¹ Gray's *Botanical Text-book* (sixth edition). Vol. II. Physiological botany. I. Outlines of the histology of phænogamous plants. By GEORGE LINCOLN GOODALE, A.M., M.D., professor of botany in Harvard University. Ivison, Blakeman, Taylor & Co., New York and Chicago. 1885. pp. vii, 194, 12mo, 141 figures.

reagents must be employed, their application requiring a horizontal stage."

In chapter I we have a discussion of the vegetable cell in general, its structure, composition and principal contents. Here it is encouraging to note that the author still holds to the view that the cell is the unit in vegetable anatomy. The most interesting portion of this chapter is that devoted to plastids (including chlorophyll), protein granules and starch. In chapter II the modifications of cells, and the tissues they compose, are taken up.

The provisional classification adopted is as follows:

- I. Cells of the fundamental system, or PARENCHYMA cells—permanent typical cells.
 1. *Parenchyma* cells, strictly so-called, including as modifications *collenchyma* cells and *sclerotic parenchyma* cells, or grit cells, such as the lignified cells of seed-coats and drupes, etc.
 2. *Epidermal* cells and their modifications, *e. g.*, trichomes.
 3. *Cork* cells, forming suberous parenchyma, or cork.
- II. Cells and modified cells of the fibro-vascular system—PROSENCHYMA in the widest sense.
 1. Cells of *prosenchyma* proper.
 - a. Typical wood-cells and woody fibers, including libriform cells and the secondary wood-cells.
 - b. Vasiiform wood-cells or tracheids.
 2. *Vessels* or ducts.
 - a. Dotted.
 - b. Spirally marked.
 - c. Annular.
 - d. Reticulated.
 - e. Trabecular.
 3. *Bast-cells*, bast-fibers or liber-fibers.
- III. SIEVE-CELLS, or cirrhose cells.
- IV. LATEX-CELLS.

It will be observed that four principal kinds of cells are here recognized, implying four kinds of tissues. Parenchyma is made to include collenchyma and short-celled sclerenchyma, and prosenchyma likewise includes fibrous cells as well as vessels (tracheary tissue).

Chapter III is devoted to the minute structure and development of root, stem and leaf of phanerogamous plants. The treatment of these subjects is very full and, to our mind, quite satisfactory, although one of the most difficult of clear presentation. The fourth and fifth chapters are devoted respectively to the minute structure and development of the flower, fruit and seed, and the physiological classification of tissues, both of which subjects are briefly treated. The last chapter is particularly interesting, and one finishes reading it with the regret that it had not been made longer.

We shall reserve the discussion of some points in the chapters before us until after the appearance of part second, but in the

meantime must congratulate the botanical fraternity of this country upon the appearance of this profound and still clearly written work.—*Charles E. Bessey.*

SMITH'S DISEASES OF FIELD AND GARDEN CROPS.¹—In this compact little volume the author has brought together the notes of a course of lectures given at the request of the officers of the Institute of Agriculture at the British Museum, South Kensington. It was the endeavor of the author, we are informed in the introduction, to keep three objects clearly in view, viz., "*first*, the description only of such diseases as are of economic importance; *second*, the definition of all the phenomena of the diseases in familiar words, such as, with proper attention, may be understood by all; this has been done without sacrificing scientific accuracy, as all botanical terms in common use are adverted to and explained; *third*, the consideration of the best means of preventing the attacks of plant diseases."

An examination of the book warrants us in saying that the author has succeeded admirably in his attempt. Every progressive farmer and gardener ought to procure this book and give it a careful reading.

While thus commending this book as a most excellent one in plan and purpose, we need not accept all the author's views. But this will not necessarily lessen the value of the work for those for whose benefit it was designed.—*Charles E. Bessey.*

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.¹

ASIA.—*The Island of Formosa*.—A paper recently read by Mr. M. Beazeley, before the Royal Geographical Society, gave much information about this little-known island, and elicited more from other members. The Chinese do not seem to have been acquainted with the island until 1403, although it is distinctly visible from the mainland and islands of the Chinese coast. So little did the Chinese emperors know or care about it, that in 1624 they ceded it to the Dutch in exchange for the small group of the Pescadores. Previously to this the Spanish and Portuguese had traded there, and it is supposed that the curious red brick fort at Tamsui, now the British consulate, was built by the Spaniards in the 16th century. The Dutch drove the Japanese from Anping, fortified themselves in Fort Zealandia, and held the island until they were driven out by the celebrated piratical chieftain, Ching Ching-kung, whose grandson handed the island over to the Chinese government, and received his pardon.

Formosa strait, between the island and the mainland, is 245 miles wide at its southern end, but only $62\frac{1}{2}$ at its northern end. The island is 245 miles in greatest length, and 76 in greatest width, and is computed to contain 14,982 square miles. A range of mountains, averaging about 12,000 feet in height, extends down the center of the island for the greater part of its length. The ridge of this range is extremely level, though heights varying from 11,300 to 12,850 feet have been made out. Mr. Beazeley declares them to be wooded to the very top, but Mr. Barber states that he has seen snow on the northern parts of the range late in June. There are now no good harbors in Formosa, owing to the fact that the island is rising at quite a perceptible rate. During the Dutch occupation in the 17th century the capital, Taiwanfu, was a port, Fort Zealandia was an island far out to sea, and an extensive harbor and bay separated the two. This is now a level plain of many miles in extent, and passengers are landed in catamarans at Anping, under the ruins of the old fort. Anping is merely an open roadstead with no shelter in the south-west monsoon, during which no vessels visit it. Tamsui, in the north, is at the mouth of a river, with only $1\frac{1}{2}$ fathoms on the bar, and $2\frac{1}{2}$ fathoms inside, with bad holding-ground. Kelung, also in the north, is very small and much exposed during the north-east monsoon. Takow, in the south-west, twenty-four miles south of Anping, has a shifting bar and a very narrow entrance, while only the outer end of the lagoon affords anchorage. There is a small harbor at Sao bay on the east coast. The neighboring small group of the Pescadores has two fine harbors, Ponghou and Makung, and it would be absolutely necessary for any foreign

¹ This department is edited by W. N. LOCKINGTON, Philadelphia.

power that wished to hold Formosa to possess these harbors. At present Amoy is practically the port of Formosa, and the produce of the island is sent thither in small vessels. There are no active volcanoes in the island, but there are signs of volcanic action in boiling springs, etc., and earthquakes are frequent.

When Mr. Beazeley accompanied a party in 1875 to select a site for a lighthouse at the South cape, Chinese authority had not extended so far as it now has, and it was not without much difficulty and some danger that the travelers made their way from Takow to the cape. The Chinese inhabitants of the country are described as apparently well-to-do, the villages clean and the children, who are mostly naked, healthy and strong. The mangoes grown in Formosa closely resemble the Bombay mango in appearance and flavor, and the pineapples are without a crown of leaves. The aborigines are much darker and more muscular than the Chinese, wear nothing but a scanty blue cloth round the waist, and are armed with bows and arrows and long knives. Many carry matchlocks. In shape Formosa has been compared to a cleaver with a short handle, or to a fish, the tail or handle being the narrow part just north of the South cape. It is certainly one of the most beautiful and fertile spots on the face of the earth.

Northern Afghanistan.—The northern part of Afghanistan is watered by the Heri-rud, Murghab and affluents of the Amu-Daria, and thus belongs to the Aralo-Caspian basin. The Afghans do not extend beyond the mountains (Hindoo Koosh, Parapomismus, etc.) except in the north-west at Herat, though they hold in military subjection the Mongol tribes of the lowland areas. The Hazareh, etc. (Mongolian) of the mountains east and south-east of Herat are independent, and the region between the Murghab and Heri-rud is occupied by Turkoman tribes, among whom are about 30,000 who have recently come southward from Merv. Eastward of these Turanian tribes are various peoples of Iranian race, some of whom are thought to be the aboriginal inhabitants of this mountain land—the supposed cradle of the Aryan stock. Among these are the Black Kafirs or Siah-posh, who alone of these tribes have not embraced Mohammedanism, who use tables and chairs and into whose country an Afghan dare not penetrate. North of these are the Badakshi. The Russians claim that the Hindoo Koosh forms the northern limit of Afghanistan, but north of this line, at its eastern extremity, Aryan tribes extend even to Darwaz and Karateghin.

Asiatic Notes.—Two hundred and fifty representatives of the Hsi-Fans, or tributary aboriginal tribes of Thibetan race which live scattered along the Thibetan border of China from Yunnan to Kan-su, are now in Pekin. The Hsi-Fans are short, fond of red clothing, and adopt Chinese fashions in no small degree. Their faces are rounder than those of the Chinese, their heads

smaller, their noses less stunted, small and pointed. Their eyes are small, placed in a line, and have a bright black luster. Quiet though they are now, history shows that they struggled manfully against the Chinese. The Lolos of Sze-Chuan are allied to the Burmese, and seem to form a nation. Both they and the Hsi-Fans belong to the Eastern Himalaic, while the rest of the aboriginal tribes in Western China and in the southern provinces, whether Miao, Rao or Tung, seem to belong to the Eastern Himalaic, the branch to which belong the Siamese, Shans, Laos, the Li of Hainan, the Cambodians and the Anamese.—Dr. Grishimailo's travels in Ferghana and the Altai have resulted in large geological and entomological collections, as well as in much anthropological matter. Many evidences of the existence of a glacial epoch in Central Asia were met with, amongst them the presence in Thian-shan of forms which have hitherto only been found in Labrador, Greenland, Lapland and the Swiss Alps.—M. Ed. Cotteau has ascended several of the Javan volcanoes, viz., Mt. Cheda, 9844 feet; Mt. Merapi, 9459 feet; Mt. Bromo, 8203 feet, and still active; and Mt. Smeru, 12,469 feet high, the culminating peak of Java. M. Cotteau states that to one accustomed to Swiss mountain-climbing the ascent of these volcanoes is child's play.

AFRICA.—*African Notes*.—M. Dolisie, a member of the Brazza mission, has traveled from Loango to Brazzaville. The "king" of the country gave to the traveler an excellent piece of ground at the confluence of the Ludima with the Kuilu, and had signed a treaty placing all the country between the Ludima and the Niari under the protectorate of France. This prince and all his chiefs also signed a solemn declaration that they had never ceded any of their rights to the International Society, which did not even own the land on which their stations were built. The route was preferable to that of the Congo and even to that of the Ogowé. Both the entrances of this route on the coast of Loango and its termination at Brazzaville are in the hands of France.—M. Giraud has again been unsuccessful in his attempt to continue his explorations, having been abandoned by his porters and his escort.—The French have the command of the Niger from Bourré to Boussa, some 700 leagues of watercourse. From the north of Africa a French railway runs from Arzen to Méchéria, and in a few years will be extended to Imsalah, which is already connected with Timbuctoo by caravan routes. The latter will become more important under French protection. The French will certainly also push from Porto Novo on the Gulf of Guinea to Boussa on the Niger, and thus complete their communication between the Mediterranean and the Gulf of Guinea.—Dr. Colin, of the French navy, has recently explored the valley of the Faléme, one of the most considerable affluents of the Senegal. The river, though it cannot be considered navigable, can be made so by removing a few rocks which obstruct its pas-

sage. Small canoes ascend it even now, and it could easily be made accessible to small steamers, since it has neither falls nor rapids. Life is intense throughout the valley, the vegetation for from one to three hundred meters on each bank is so thick that it was only at intervals that our traveler could approach the river; elephants, lions, buffaloes, antelopes, etc., as well as birds abound, and numerous villages are situated within a few kilometers of its course. Gold is found in its sands. Leaving Podor June 24, 1883, he left the Faléme at Senondébau, an abandoned French fort, and proceeded thence to Dialafara, the capital of Tambura, a country rich in cattle and gold, and induced the sovereign to sign a treaty of protectorate. From Dialafara Dr. Colin went to Kassama, capital of Diébedugu, a city before unknown to Europeans. Kassama seemed so important that Dr. Colin endeavored to find a practicable route from thence to the terminus of the French railway at Bafulabé, but failed.—M. Tomczek, the companion of M. Rogovinski in the exploration of the Cameroons region, died at Mondoleh, May 10, 1884, aged 24 years. Notwithstanding his youth, he had got together a vocabulary of the Kruman language, explored the Rio del Rey, and taken many notes upon the country.—Not only M. Rogovinski, but M. Passavant of Basle, has resolved to advance into the interior of the Cameroons region in search of the mysterious Lake Liba.—In his last journey Mr. Stanley ascended the Aruwimi to Tamba, $2^{\circ} 43'$ N. lat. At that point the river is called Biyere, farther on it is the Berre and the Werré, and Mr. Stanley believes it to be identical with the Welle of the south of the Soudan. He discovered on this journey the Lulemgu, an important affluent upon the right bank, and established a station upon the island of Wana-Rusani, near the right bank of the river, in $0^{\circ} 10'$ N. lat.

AMERICA.—*Norse and Portuguese Colonies in North America.*—Mr. R. G. Haliburton (Proc. Roy. Geog. Society, January, 1885) identifies the "Vinland the Good" of Eric the Red with Newfoundland. The length of the day given in the Greenland Saga coincides with that of Newfoundland, and the man who called his first find Greenland in order to attract colonists, would not scruple to give a good name to the land found by his son, Leif. Wild grapes are said to occur on the west coast, and this was enough for Eric to magnify into shiploads of grapes and a semi-tropical winter climate. The Helluland of the Saga is, by Mr. Haliburton identified with Labrador, the southern part of which was Markland, while Genunga gap was Belle Isle strait. It was not known until the publication, in 1883, of "Os Corte Raes," by Senhor Ernesto do Canto, that from 1500 to 1579 commissions were regularly issued to the Corte Reals as governors of Terra Nova, and that at least three settlements were made by the Portuguese. Except, perhaps, the Vinland of the Norsemen, this colony, which included Labrador, Newfoundland, Nova Scotia

and probably a large portion of the east coast of the United States, was by far the oldest European colony in the new world, since the date 1500 is but two years after the discovery of America by Columbus and six years after its discovery by Cabot. In 1500 Gaspar Corte Real explored Labrador, probably nearly to Hudson strait, and also Newfoundland and Nova Scotia. In 1521 Fagundes obtained a grant of the country between the land of the Corte Reals (Newfoundland) and the Spanish colonies, and a settlement was made at Cape Breton. Traditions of this settlement exist among the Micmacs, who aver that certain earth-mounds at St. Peter's, Cape Breton, were made by white men before the French came. An archaic cannon, formed of bars of iron, was found many years ago, and an inquiry into the date of the manufacture of such guns showed that it must have been made between 1500 and 1545. Terra Nova was not actually settled, but the fisheries were actively prosecuted. The fate of this colony is not known, but in 1567 a Portuguese settlement was made at Inganish, Cape Breton. In 1580 the annexation of Portugal to Spain brought the region under Spanish authority, and a colony was sent out which appears to have had a melancholy end, since our only account of it is that the French convicts left on Sable island in 1598 built barracks to protect themselves out of the wrecks of the Spanish vessels. The name of "Spanish Harbor" is all that marks their passage. Few persons imagine that the Bay of Fundy is "*Baya Fonda*," the deep bay, and that Cape Race is "*Cabo Raso*," or bare cape; names given by the Portuguese.

Source of the Mississippi.—The true source of the Mississippi was found by Captain Glazier to be in a lake in lat. $47^{\circ} 13' 25''$, and situated three feet above Lake Itasca, the hitherto supposed source of the river. The source is therefore 1578 feet above the Atlantic, and the length of the river, taking former data as the basis, may be placed at 3184 miles.

The Fuegians.—The total population of Terra del Fuego is not above 8000, consisting of about 2000 Onas, hunters, evidently of Tehuelch or Patagonian origin, in the east; about 3000 Alaculufs, hunters and fishers in the west and 3000 Yahgans, fishers, in the south. Numerous kitchen-middens of vast size and great age show that the island was inhabited even before the opening of Magellan straits. Those of Elizabeth island, the largest, oldest and most interesting, are from twenty to twenty-five feet above the sea-level, and are covered with a layer of fine sea-sand some forty-five inches thick, above which comes an accumulation of rich vegetable humus overgrown with herbaceous vegetation. The lower stratum of refuse contains *Mytilus patagonius* and other shells, with fragments of *Otaria jubata* and a few other mammals, but no split bones, human remains, traces of pottery or weapons, save a few rudely-shaped spear or arrow-heads. The modern heaps are very similar. In

the face of the great degradation of these peoples the English missionaries assert the language of the Yahgans contains no less than 30,000 words, "suggesting the hypothesis of an origin very different and far superior to their present state."

GEOLOGY AND PALÆONTOLOGY.

THE OLDEST TERTIARY MAMMALIA.—The lowest horizon of the Puerco epoch of New Mexico has recently been explored by David Baldwin with good results. The following is a list of the species of Mammalia obtained by him. The proportion of novelties, it will be seen, is large:

Polymastodon ? taoënsis Cope.

Polymastodon latimolis, sp. nov.—This marsupial equals the *P. taoënsis* in size, and is therefore larger than either the *P. fissidens* or the *P. foliatus*. It differs especially from both the *P. taoënsis* and the *P. foliatus* in the great shortness of the first true inferior molar, which is only one-half longer than the second or last true molar. The latter is as wide as long in the type, and a little narrower in a second specimen. It supports four tubercles on the inner side; outer side worn. The first true molar appears to have five tubercles on the inner side, although the anterior edge is injured. In *P. taoënsis* there are six or seven. The fourth premolar is two-rooted. The enamel of the last inferior molar is faintly longitudinally wrinkled. The coronoid process rises opposite the middle of the second true molar.

Measurements: Total length of molar series, M. .038; of second true molar .017; width of do. .011; length of crown of second true molar .014; width of do. .011. Depth of ramus at M. .038; do. at diastema .024. Depth of ramus of a second individual .042. Besides the shortness of the second true molar, the width of the same tooth and of the last true molar distinguish this species from the *P. taoënsis*. The inflection of the angle of the ramus of the lower jaw is as well marked as in other species of the genus.

Chriacus hyattianus, sp. nov.—Represented by two maxillary bones with molar teeth, one of which is accompanied by a broken mandibular ramus, which supports the second true molar and parts of other teeth. The superior molars are quite peculiar, and are especially characterized by their small transverse as compared with their anteroposterior diameter. The crowns are surrounded by a cingulum, except on the inner side, where distinct traces of it are visible. The external cusps are small and low and flattened on the external side, and are connected at their bases by a low ridge. They send inwards each an angular ridge which unites with its fellow in an angular internal cusp of little elevation, enclosing a triangular fossa. Small angular intermediate tubercles exist at the internal bases of the external cusps. The posterior cingulum is a little better developed than the anterior, and rises

into a very small cusp or tubercle, which is not of sufficient size to truncate the internal outline of the crown. The crown of the second true inferior molar displays a contracted triangle of three well developed cusps anteriorly, and a wide basin posteriorly. The rim of this basin is elevated all round and develops into a cusp on the external side. An external, no internal cingulum. Enamel longitudinally wrinkled.

Measurements: Length of three true molars .0185; diameters of M. 11, anteroposterior .0075, transverse .0075; do. of second inferior true molar, anteroposterior .0075, transverse posteriorly .006. As the fourth inferior premolar of this species is unknown, its reference to the genera Chriacus is provisional only. It is dedicated to my friend, Professor Alpheus Hyatt, of Boston, Mass.

Mixodectes ? sp.—Two rami with true molars.

Loxolophus adapinus, gen. et sp. nov.—*Char. gen.*—Known only from inferior molars. Crowns with three cusps anteriorly and a basin posteriorly. The internal and external anterior so connected as to form a transverse crest on a little wear; anterior or fifth cusp distinct. Rim of basin elevated on the external side and extending as a crest to the base of the anterior cusps. Internal rim acute, and so near the external as to resemble a large cingulum. Third true molar with a small heel. The position of this genus cannot be determined without further material. The oblique direction of the crests resembles what is seen in the genus *Adapis* Cuv.

Char. specif.—The posterior rim only rises into a cusp at the posterior external angle. There are no cingula. The enamel is slightly wrinkled longitudinally. The posterior molar is considerably smaller than the first, which is a little smaller than the second. The last molar rises obliquely with the anterior base of the coronoid process. The anterior masseteric ridge is quite predominant, but the fossa is not distinctly bounded below.

Measurements; Length of true molars .019; of last molar .006; width of do. .003; length of second true molar .007; width of do. .0045

Sarcothraustes coryphæus, sp. nov.—Represented by a considerable part of a cranium, which supports the true molars of both sides, and the fourth premolar of one side. The absence of the mandible leaves the generic reference somewhat uncertain. The superior molars resemble those of the *Trisodon canidens* M., and those of the *Sarcothraustes antiquus* M. As these genera have been kept apart on account of differences in the superior dentition, and as only the true inferior molars of the former are known, and probably only the inferior premolars of the latter, both may belong to the same genus, *i. e.*, *Sarcothraustes*. The present species is smaller than either of the above-named, and differs in various points in the superior molars.

The crowns of the superior molars support two external conical cusps which stand close together, but are entirely distinct, and have a circular section. There is a single internal conical cusp flattened on the external side. The entire crown is surrounded by a well developed cingulum, which is especially prominent round the external anterior cusp of the second and third true molars. The posterior external cusp of the last true molar is rudimental, and is situated well within the external line on the posterior border. The fourth premolar has a single external cusp, and the cingulum is wanting on the anterior and interior sides. The outline of the base of the crown of this tooth is subtriangular; that of the first and second true molars is a half ellipse; while that of the last true molar is a transverse oval as in the two species mentioned above. In this last respect it differs from the species of *Mesonyx* and *Dissacus*, where that tooth has a triangular base. Enamel delicately wrinkled where unworn. In the two species of *Sarcothraustes* already mentioned the first and second true molars have a triangular outline, and there is no internal cingulum.

The occiput of this species rises into an elevated transverse crest with an oval outline, like that of the *Dinocerata*. This is divided in front by an elevated sagittal crest. The brain cavity is very small. There is a preglenoid crest.

Measurements: Length of true molars .031; diameters of Pm. IV, anteroposterior .010, transverse .012; do. of M. II, anteroposterior .011, transverse .016; do. of M. III, anteroposterior .008, transverse .015; elevation of occipital crest .058.

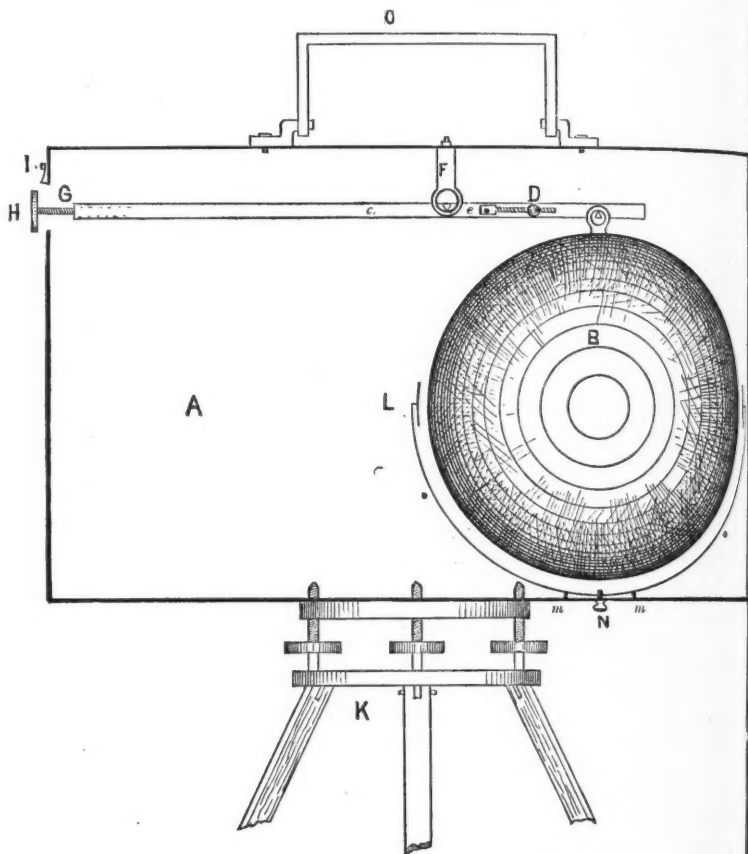
Phenacodus puericensis Cope.

Periptychus coarctatus Cope.

A BAROMETER FOR MEASURING SEPARATELY THE WEIGHT AND PRESSURE OF THE AIR.—The present mercurial barometer at all times measures, not alone the weight or pressure of the air, but both weight and pressure. It cannot measure either separately, that is, we cannot *know* when either pressure or weight alone has affected it. It is the purpose of this article to suggest a barometer that will measure alone the weight of the air and not be at all influenced by pressure, temperature, moisture or the sun's or moon's attraction. The central idea of this plan is not new, but the special construction to accomplish the end sought, I think, is.

Take a hollow glass sphere (*B*, as shown in the figure) and exhaust the air (by means of mercury or otherwise). Suspend it from one end of a balance beam, *c*. Put the whole in a glass walled box, *A*. Such box may be mounted on a tripod, *K*, with leveling screws. Into the opposite end of the balance beam, *c* (from the sphere) is inserted a screw, *G*, with threads measuring one hundredth of an inch, with a large circular head, *H*, graduated into divisions of one-tenth of its outside circumference,

which in connection with a vernier, *I*, will read to tenths of these or one hundredth of the circumference, or, as a whole, to one ten-thousandth of an inch. *H*, or the head of the screw, extends through a hole in the glass box, so as to be turned by hand. To the right of the fulcrum, *F*, is a screw, *e*, on which a ball, *D*, works, and is for the purpose of adjusting the balance at mean



sea-level. When this is done the screw, *G*, is run in or out as the case may be to measure the increase or decrease of the weight of air. The screw, *G*, might be made to carry a vernier along the balance bar, *c*, to register the number of turns of the screw, but such is not shown in this sketch. *O* is a handle for carrying the box by hand. *m m* are fulcrums on which a spring bow, *o o*, rests.

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On the ends of this bow are two clamps, *L L*, for holding and steadying the sphere, *B*, when being moved or carried from place to place. The clamp screw, *N*, is turned so as to draw downward the bow, *o o*, between the fulcrums, *m m*, which causes the upper ends of the bow to clamp the sphere. Four clamps may be used.

I think it will be plain to any one that the *presence* of the air, or the attraction of the earth, sun or moon will be equally exerted on the sphere, *B*, and the balancing weight (screw *G*). Also, that the difference in the weight of the sphere, *B*, before the air is exhausted and afterward, is the weight of the air exhausted. Also, that the difference in the turn of the screw, *G*, from its position at sea-level, and any tried elevation above, to balance the sphere, is the comparative weight of the air at the two places.

If experience should prove that the accumulation of dust and moisture on the sphere, *B*, will materially affect the weight thereof, it can be obviated by balancing the sphere, *B*, with another of the same surface and weight (exhausted air excepted), which can be moved to the right or left on the left end of the balance beam, *c*, by means of a screw similar to *G*, and have the number of turns recorded by a vernier on the balance beam.

I have seen the mercurial barometer affected by the sudden opening or closing of a door in a tight room where the barometer was hung. I think I was not mistaken when I thought I saw it vibrate with the sudden dashing March winds which are strong enough sometimes to stagger a man as he walks. The plan I suggest will not be affected by these conditions if kept out of the wind current. It will be interesting to compare its action with the mercurial barometer anyway.—*Jno. T. Campbell, Rockville, Ind., Jan. 24, 1885.*

THE ERIBOLL CRYSTALLINE ROCKS.—*Nature* contains two lengthy articles upon the crystalline rocks of the Scottish highlands, the one from the pen of Archibald Geikie, the other a report by B. N. Peach and John Horne. It appears a fresh element of difficulty has been introduced into the geology of the Highlands. The crystalline schists which in Northwest Sutherland overlie fossiliferous Silurian strata, and which were believed by Murchison to be newer than those strata, are actually older, and overlie the newer rocks by virtue of reversed faults accompanied by "thrust-planes" or horizontal pushings forward of the rocks on the up-throw side. The coast sections of Loch Eriboll show these dislocations clearly. Beginning with gentle foldings they increase until the order of the strata is reversed. In Durness, for example, the overlying schists have been thrust over westwards across all the other rocks for at least ten miles. Some of the overlying bands are Archæan gneiss, others Silurian quartzite, and in one case a mass of the Upper

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Durness limestone can be detected. The crystallization increases, however, so much that it becomes impossible to determine the original character of the rock by examination in the field. From the remarkably constant relation between the dip of the Silurian strata and the inclination of their reversed faults, Professor Geikie concludes that these dislocations took place before the strata had been seriously disturbed.

THE THEATER OF THE EARTHQUAKES IN SPAIN.—M. Hébert recently presented to the French Academy of Sciences a communication upon the earthquakes in the south of Spain—cataclysms more violent than any which have visited Spain in historic times. If the details furnished by the papers are examined, it will be evident that the localities recently disturbed by earthquakes are almost all situated on two zones, the one to the south of the Jurassic and Cretaceous mass which bounds the provinces of Malaga and Granada, the other to the north of it. In the southern zone the most severely visited localities were Antequera, Malaga, Velez, Torros, Alhama, Granada, etc.; while the northern zone comprehends Cadiz, Xerez, Seville, Cordova, Linares, etc., and Valencia, all towns where shocks have been felt. The rest of the peninsula does not seem to have suffered much from this instability of the Mediterranean regions, except Albuquerque in the parallel of Lisbon, destroyed Dec. 26th and 27th, and some slight shocks in Galicia. M. Hébert called attention to the Balearic isles, which are situated between the two zones, are elevated eighty meters or more above the sea-level, and are composed at the surface of horizontal beds of Quaternary age. These islands have therefore been raised more than a hundred meters since the Quaternary epoch, and this elevation has been limited northward and southward by fractures in the line of prolongation of the defined zones of dislocation above. Thus it is clear that the cause of dislocations in these regions is always present and always active.

GEOLOGICAL NOTES.—*General*.—A letter from Capt. C. E. Dutton upon the basalt fields of New Mexico, has been contributed to *Nature*. The center of activity is Mount Taylor, otherwise the San Mateo mountains, a volcanic pile 11,380 feet high, carved into numerous spurs by magnificent gorges. It was originally built by outbreaks both from its flanks and summit. From this center the lavas reach out for forty-five miles to the north-north-east, and in other directions for from eighteen to thirty miles. Beyond the immediate base of the mountain the lava forms a superficial sheet over each mesa or table, varying in thickness from fifty to two hundred feet. Erosion has cut through the lava and the underlying sedimentary strata, leaving mesas sometimes separated two or three miles from the parent mass. Many of the vents scattered around the flanks of Mount Taylor can be easily

identified. The "necks" or "chimneys" which are left standing in the valley plains beyond the farthest verge of the lava-capped mesas form one of the most striking features of the country. One is nearly two thousand feet high. In the wide valley-plains between the mesas are newer fields of lava, some so fresh that one might think them scarcely a century old, and it is clear that they were erupted after many a square mile of strata overflowed by the older basalts had been eroded away. No vents are found in connection with these younger eruptions, nor have any scoriæ been discovered. Some of them seem to have flowed from small depressed cones at their upper ends. One stream is sixty miles long. The ejecta found in connection with the older basalts are in relatively small quantity. Cliffs, mesas, terraces, carved buttes and gorgeous colors are as characteristic of the New Mexico plateau region as of that of Utah, and the Cretaceous system is better preserved. The younger basalt is much like the rougher lava of Mauna Loa.—As a conclusion of his studies upon the origin of phosphates of lime in sedimentary formations M. Dieulafoy announces that the waters which have excavated the calcareous rocks of the north-west of France, and formed the phosphorites, are *exterior* waters circulating from above downwards. It thus follows that, contrary to current ideas, deposits similar to those of which the phosphorites form part, wherever found, and whatever their importance, do not owe their origin to internal but to external causes.

Silurian.—A fossil scorpion has recently been found by M. Lindstrom in the Upper Silurian of the Island of Gothland (Sweden). The surface is so well preserved that the chitinous cuticle, compressed and wrinkled by the superincumbent beds, can be made out. The cephalothorax, abdomen with its seven dorsal plates, and tail of six segments ending in the poison-bearing sting, can be well distinguished. One of the stigmata can also be seen. M. Lindstrom has named this oldest of known land animals *Palæophones nunci*. The four pairs of thoracic feet in this scorpion are like those of the embryos of many other Tracheata and resemble those of Campodea. The same appendages in the Carboniferous scorpions are like those of existing species.

Cenomanian.—The Elobi islands, upon the west coast of Africa and in the first degree of north latitude, are formed of horizontal beds of sandstone, poor in fossils. One of the species met with, *Schlönbachia inflata*, characterizes the Lower Cenomanian of Europe, and is particularly abundant in the French departments of Yonne and Aube. These beds, according to M. Ladislos Szajnochka, are continued along the Gaboon coast to the islands of Muni and Mounda, and appear also to stretch along the west coast of Africa along the Sierra da Crista and the Sierra Campilida to Mossamedes and Benguela.

MINERALOGY AND PETROGRAPHY.¹

RECENT TEXT-BOOKS OF MINERALOGY AND PETROGRAPHY.—The appearance of the second edition of Professor E. S. Dana's well known Text-book of Mineralogy,² containing over fifty pages of new matter in the form of supplementary chapters, brings this admirable introduction to the science fully up to date, as well in respect to its treatment of the newest methods and apparatus for mineralogical investigation as in the completeness of the list of species mentioned.

Professor Gustav Tschermak's excellent Lehrbueh der Mineralogie, completed only near the end of 1883, fills the same place in the German language that Dana's text-book does in English, and fills it so well that a second revised edition has already appeared,³ having the imprint 1885. This work is especially strong in its treatment of the physical, particularly the optical, properties of minerals, as well as their modes of origin and occurrence. Considerable space is also devoted to their chemical relations, and an attempt made to classify them according to a scheme based somewhat on the periodic arrangement of the elements. The description of the species is, however, often too meager even for a text-book, many important minerals being mentioned only by name.

Professor A. de Lapparent, of Paris, author of the recent *Traité de Géologie*, has also just issued a mineralogical manual entitled *Cours de Minéralogie*.⁴ A large proportion of this work is devoted to the treatment of crystallography, in which the cumbersome system of notation suggested by Haüy and developed by Lévy and Des Cloizeaux, is retained, as indeed it is in nearly all French works on mineralogy. The arrangement of the species is merely in accordance with the frequency of their occurrence. In other words the classification is purely geological, and it is among geologists that the work will probably prove to be of the greatest use.

The second volume of Hilary Bauerman's Mineralogy,⁵ devoted to the description of species, is very unsatisfactory. Much that is very important, especially many results of the best recent mineralogical work, has been altogether disregarded, and the author conveys the impression of being by no means thoroughly acquainted with the newest methods or the latest discoveries in the science of which he treats.

Dr. Heinrich Baumhauer, well known for his researches on the figures artificially etched on crystal planes by chemical reagents

¹ Edited by Dr. GEO. H. WILLIAMS of the Johns Hopkins University, Baltimore, Md.

² Text-book of Mineralogy, new and revised edition, 1883 (Wiley & Sons).

³ Lehrbuch der Mineralogie. Zweite verbesserte Auflage. Wien, 1885.

⁴ Cours de Minéralogie. Par A. de Lapparent. 8vo, pp. 560, 519 cuts and one colored plate. Paris (Savy) 1884.

⁵ Text-book of descriptive Mineralogy. Text-books of science series. 1884.

and their relation to the symmetry of the crystal, has just published a short text-book of mineralogy,¹ which, however, is very elementary in its character, being intended only for use in high schools or for the self-instruction of beginners.

Dr. Aristides Brezina, of the University of Vienna, has published the first part of an elaborate and exhaustive series of crystallographic researches, undertaken in competition for a prize offered by the Royal Academy of Science.² The first part, although covering over 350 octavo pages, deals only with methods of investigation, and constitutes a most valuable addition to the works on mathematical crystallography.

Fr. Ulrich, of Hanover, is the author of a quarto pamphlet, containing sixteen pages, covered with figures to illustrate the relations of the crystalline forms of the different systems, the development of hemihedral forms and some characteristic combinations of common minerals.³ Many of the figures are colored, and, while roughly executed, they are useful in making plain to beginners some of the more elementary principles of crystallography. No printed explanations are appended.

A much-needed elementary text-book of microscopical mineralogy has very recently appeared, by Dr. Eugen Hussak, of Gratz.⁴ Only such species are treated as enter into the composition of rocks, and these almost exclusively in reference to their appearance and the methods of their identification in thin sections under the microscope. The first part of the book deals with the methods of microscopical petrography—the construction of the microscope and the manner in which the optical properties of minerals are used for their identification; the method of separating rock constituents by means of a heavy solution, microchemical analysis and some of the most peculiar characteristics common to all minerals when examined in thin sections. The second part contains the distinguishing microscopic peculiarities of each rock-forming species arranged in tables, as is the case in Professor Brush's manual of Determinative Mineralogy. These are sometimes too concise to be satisfactory, but they nevertheless contain a great amount of information in a very small space. The means of distinguishing similar minerals are especially emphasized. A valuable list of references to the more important microscopic studies of different rock-forming minerals, arranged alphabetically, is annexed to these tables. The book is not a text-book of petrography, since rocks themselves are not described, but

¹ *Kurzes Lehrbuch der Mineralogie einschliesslich der Petrographie.* Von H. Baumhauer. 8vo, pp. 190. Freiburg, 1884.

² *Krystallographische Untersuchungen an homologen und isomeren Reihen.* Von Dr. A. Brezina. 1 Theil, Methoden. Wien, 1884. 8vo. pp. 359.

³ *Krystallographische Figurtafeln zum Gebrauche bei mineralogischen Vorlesungen.* Von F. Ulrich. Hanover, 1885.

⁴ *Anleitung zum Bestimmen der gesteinsbildenden Mineralien.* Von Dr. E. Hussak. Leipzig, 1885, pp. 196.

rather an extension of the ordinary works on mineralogy. Although quite elementary, it will prove very valuable to those commencing work in microscopical mineralogy, to whom the vast amount of material contained in the larger manuals is often discouraging.

CROCIDOLITE FROM THE CAPE OF GOOD HOPE.—Considerable interest attaches to that fibrous stone with a rich yellowish-brown luster, which is beginning to find so wide an application in the arts, especially for the manufacture of small ornaments, and which jewelers generally designate as crocidolite. In its structure it much resembles the well-known "catseye," and when properly cut it can scarcely be distinguished from this except by its color, a fact which frequently causes it to be called "tiger's eye." The true crocidolite is an asbestiform hornblende, possessing a blue color, like its more compact equivalent glaucophane. Among other localities it occurs abundantly near the Orange river in South Africa, from which place specimens were analyzed by Klaproth¹ as early as 1815, and again by Hausmann and Stromeyer² in 1831. The latter authors gave it the name crocidolite in allusion to its fibrous structure (*κροκίς*, a wool). The occurrence of this mineral in Africa has been described by Cohen³ and Stow.⁴ The former says that a range of mountains extends in N. N. E. direction from the Orange river through the province of West Griqualand, the central part of which is known as the Asbestos mountains. Here the crocidolite occurs in veins from one to six inches in width, together with vast quantities of jasper and other forms of silica. Sometimes the crocidolite is pure and is then blue in color, soft, and easily separable into the finest fibers; more often, however, it is more or less decomposed and to a greater or less extent replaced by quartz. It is upon this alteration and replacement that the commercial value of the mineral depends. The yellowest specimens are most changed and owe their color to the almost complete oxydation of the iron. Wibel⁵ studied the mineral in 1873 and concluded that it was a complete pseudomorph of quartz after crocidolite, only the iron of the original mineral being left in the form of göthite. Renard and Klement⁶ have recently contributed an exhaustive paper on the subject. Analysis of the yellowest variety gave:

SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	CaO	MgO	H ₂ O
85.05	4.94	0.66	0.44	8.26	0.76
Total 100.11					

¹ Chemische Abhandlungen gemischten Inhalts, 1815, pp. 233-242. Beiträge, VI, p. 237, 1815.

² Götting'scher gehl. Anzeiger, II, 1831, p. 1585.

³ Neues Jahrbuch für Min., etc., 1873, p. 52.

⁴ Quarterly Journal Geol. Soc., XXX, p. 622.

⁵ Neues Jahrbuch für Min. etc., 1873, p. 367. (H. Fischer proved the same was the case for many varieties of catseye.—Tschermak Min. Mittheilungen, 1873, p. 117.)

⁶ Bull. d. l'Acad. Roy. d. Sciences de Belgique (3), VIII, 1884, 530-550.

Analysis of the more greenish or bluish kind gave :

SiO ₂	Fe ₂ O ₃	FeO	Al ₂ O ₃	CaO	MgO	H ₂ O
93.43	2.41	1.43	0.23	0.13	0.22	0.82
Total 98.67						

They announce it as the result of a microscopic examination that the mineral is not a pseudomorph, but that the silica has been deposited between the fibers, which were already more or less altered, enclosing them in a hard transparent matrix.

PETROGRAPHICAL NOTES. — Becke¹ gives, in good form, the methods for microscopically distinguishing augite and bronzite. — Scharizer, of Vienna, has studied the hornblende from Jan Mayen, and appends some interesting remarks regarding the general chemical constitution of the aluminous hornblendes.² He regards them as isomorphous mixtures of typical actinolite (Mg Fe)₃ Ca Si Si₃ O₁₂ and a molecule R₃ R₂ Si₃ O₁₂, to which he applies Breithaupt's old name, syntagmatite. — Merian contributes an interesting attempt to trace the relation between the composition of an eruptive rock and that of the pyroxene mineral which it contains.³ — J. Eliot Wolff gives a short note on the occurrence of nephelinite and nepheline-tephrite, both rich in a mineral of the sodalite group and often containing olivine, in the Crazy mountains, an isolated range north of the Yellowstone river, in Montana.⁴ These rocks have never before been observed within the limits of the U. S. — Very interesting is the discovery, by J. S. Diller, of a new type of volcanic rock—a hypersthene basalt—on Mt. Thielson, Oregon,⁵ on the surface of which fulgurites were found to be largely developed. This rock is new, but exactly fills a vacancy in the accepted rock classification. — The same writer mentions peridotites which break through the Carboniferous strata of Kentucky in the form of dykes, enclosing fragments of the adjacent rock. He also finds, upon microscopic examination, that the rock of the new volcano on Bogosloff island, near Alaska, is a hornblende-andessite.⁶ — Renard has given an elaborate microscopic study of the volcanic and cosmic dust that forms so large a portion of the deepest ocean deposits.⁷ — Holst and Eichstadt⁸ have described from Slättmossa, in Sweden, an amphibole granite having a beautiful spherulitic structure not inferior to that of the well known "napoleonite" or "corsite," a nodular diorite from Corsica, described by Vogel-

¹ Tschermak Min. Pet. Mittheilungen, v, 1883, p. 527.

² Neues Jahrbuch für Min, etc., 1884, II, p. 143.

³ Ib., III Beil. Band, p. 252, 1885.

⁴ Ib., 1885, I, p. 69.

⁵ Amer. Jour. Science, Oct. 1884, p. 253.

⁶ Science, v, pp. 65 and 66, Jan. 23, 1885.

⁷ Bull. Mus. Roy. d'Hist. Nat. d. Belgique, III, 1884, 1-24. *Nature*, April 17, 1884.

⁸ Geol. Fören. i. Stockholm Förh., 1884, Vol. VII, p. 134.

sang (Niederrhein. Gesell. für Natur-und Heilkunde, 1862). A similar diorite has been mentioned by Reinhold¹ as occurring in Placer county, Cal. (vid. NATURALIST, 1882, p. 610).—Michel-Lévy² has established seven different types of volcanic rock occurring in and near Mont Dore, in Central France. They include domite, cinerite, trachyte, andesite, phonolite and basalt.

BOTANY.³

HYBRIDIZATION OF POTATOES.—During the past year some experiments were made at Reading, England, upon the grounds of Messrs. Sutton & Sons, the eminent potato growers. Under the advice of Mr. J. G. Baker the attempt was made to secure a hybrid between the common potato and the Darwin potato (*Solanum maglia*) from the southern part of South America. The experiment is reported as having been successful, and we may look ere long for the tubers of this new form. "Every gardener and farmer may now welcome the birth, so to speak, of a hybrid which we may hope will enable the potato plant to resist the attack of parasites, and especially of those of the devastating fungus, *Peronospora infestans*."

HETEROECISM OF CEDAR APPLES.—Dr. Farlow has been studying the cedar apples (species of *Gymnosporangium*) with a view to determining whether the cluster cups (species of *Ræstelia*) of the apple (*Pirus*), hawthorn (*Cratægus*) and June-berry (*Amelanchier*) are stages of the fungus which occurs on species of cedars (*Juniperus*). In a recent paper read before the American Academy of Arts and Sciences, the results of a series of experiments are given, the general bearing of which is in favor of the doctrine of heteroecism. After discussing the difficulties and the objections which may be raised, the author says that "the conclusions to be drawn are, that:

"1. The æcidium of *Gymnosporangium biseptatum* is probably *Ræstelia botryapites* [on *Amelanchier*].

"2. The æcidium of *G. globosum* (to be kept distinct from *G. fuscum*) is possibly *Ræstelia aurantiaca* [on *Cratægus oxycantha*].

"3. The æcidium of *G. macropus* is to be sought among the *Ræsteliæ* growing especially on apples and *Amelanchier*."

NORTH AMERICAN FORESTS.—The North American continent, or that part of it situated north of Mexico, may be conveniently divided, with reference to its forest geography, into the Atlantic and the Pacific regions by a line following the eastern base of the Rocky mountains and its outlying eastern ranges from the Arctic circle to the Rio Grande. The forests which cover these two divisions of the continent differ as widely in natural features, composition

¹ Proc. Philad. Acad. Nat. Science, 1882, p. 59.

² Comptes Rendus, T. xcvi, 1884, p. 1394.

³ Edited by PROF. C. E. BESSEY, Lincoln, Nebraska.

and distribution, as the climate and topography of Eastern America differ from the climate and topography of the Pacific slope. The causes which have produced the dissimilar composition of these two forests must be sought in the climatic conditions of a geological era earlier than our own and in the actual topographical formation of the continent.

The forests of the Atlantic and the Pacific regions, dissimilar in composition in the central part of the continent, are united at the north by a broad belt of sub-arctic forests, extending across the continent north of the fiftieth degree of latitude. One half of the species of which this northern portion is composed, extends from the Atlantic to the Pacific; and its general features, although differing east and west of the continental divide, in conformity with the climatic conditions peculiar to the Atlantic and the Pacific sides of the continent, still possess considerable uniformity. The forests of the Atlantic and the Pacific regions are also united at the south by a narrow strip of the flora peculiar to the plateau of Northern Mexico, here extending northward into the United States. Certain characteristic species of this flora extend from the Gulf of Mexico to the shores of the Pacific, and while the peculiar features of the eastern and the western slopes of the interior mountain system of the continent are still maintained here, the Atlantic and the Pacific regions of the Mexican forest belt possess many general features in common. Typical North American species, moreover, peculiar to the forests of the Atlantic or of the Pacific, mingle upon the Black hills of Dakota and upon the Guadalupe and other mountains of Western Texas, the extreme eastern ridges of the Rocky Mountain range and the outposts between the Atlantic and the Pacific regions.—*Professor Sargent in Vol. ix of the 10th Census of the United States.*

THE FERTILIZATION OF THE LEATHER-FLOWER (CLEMATIS VIORNA).—The leather-flower is a rather curious plant, climbing by means of its leaf-stalks among the low underbrush. The flower (Fig. 1) it bears is bell-shaped and hangs pendent from a somewhat long peduncle, which extends in a horizontal direction. It has no petals; four sepals taking their place. These are very thick and leathery, and are colored purplish without. The edges and inner part of the sepals are white. The tips are recurved, and these, together with the white edges of the sepals, perhaps serve as guide marks, directing the insect to the entrance below as a means of obtaining the honey. The bee, which I find to be the fertilizing agent, holds to the recurved tips of the sepals while effecting its honey-gathering, and this is the more obvious purpose of these tips. The outer stamens begin to open first, then those next within, being in advance of the pistils.

But before the inner stamens are ready to shed their pollen, the stigmas are also ready, so that were it not for a very ingenious

arrangement, pollination would easily take place. The back of the anthers and the entire surface of the little tips extending above them are hairy. So are likewise the styles (Fig. 3). The calyx is closely contracted at its opening, pressing together the numerous stamens and pistils into a compact mass. Owing to the greater size of the pistils, the stigmas extend beyond the anthers (Fig. 4), and since the close packing brings the hairs on the

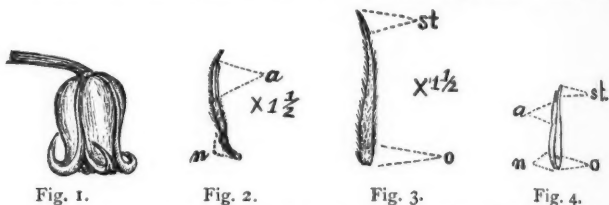


FIG. 1.—A flower, natural size. FIG. 2.—A stamen enlarged $1\frac{1}{2}$ times; *a*, the anther; *n*, the nectary. FIG. 3.—A pistil enlarged $1\frac{1}{2}$ times; *o*, the ovary; *st*, the stigma; FIG. 4.—A pistil and a stamen about natural size, showing relative length.

anthers into play, the pollen does not escape. But at a later period the pressure of the sepals relaxes, the stamens are looser, and self-fertilization is not absolutely impossible, but certainly unnecessary, judging by the frequent visits of bees. The insertion of the bee's proboscis releases the pollen, which falls upon the abdomen and thorax, to be left upon the more prominent stigmas of the next blossom. The nectary is at the base of the filament.—*Aug. F. Foerste, Granville, Ohio.*

PLANT MIGRATIONS.—Fifteen years ago there were no dandelions in the Ames flora (in Central Iowa), now they are very abundant, and have been for half a dozen years. Then there were no mulleins (*Verbascum thapsus*), now there are a few. Then the low and evil-smelling *Dysodia chrysanthemoides* grew by the roadside in great abundance, now it is scarcely to be found, and is replaced by the introduced "dog-fennel" (*Anthemis cotula*). Then the small fleabane (*Erigeron divaricatum*) abounded on dry soils, now it is rapidly disappearing. Then no squirrel-tail grass (*Hordeum jubatum*) grew in the flora, now it is very abundant, and has been for ten years. Then there was no bur-grass in the flora, now it is frequently found, and appears to be rapidly increasing. Both of these grasses have apparently come in from the west and north-west. Fifteen years ago the low amaranth (*Amarantus bioides*) was rather rarely found; now it is abundant and has migrated fully 150 miles north-eastward. This plant has certainly come into the Ames flora from the south-west within the last twenty years.

In Nebraska, I am informed by the old settlers, that there have been notable migrations of plants within the past twenty or thirty years. The buffalo grasses of various kinds were formerly abun-

dant in the eastern part of the State, now they have retreated a hundred to a hundred and fifty miles, and have been followed up by the blue-stems (*Andropogon* and *Chrysopogon*). The blue-stems now grow in great luxuriance all over great tracts of the plains of Eastern Nebraska, where twenty years ago the ground was practically bare, being but thinly covered by buffalo grasses. In Dakota it is the same, the blue-stems are marching across the plains, and turning what were once but little better than deserts into grassy prairies.—*Charles E. Bessey*.

GRAY'S BOTANICAL CONTRIBUTIONS, 1884-'85.—These occupy fifty-four pages of the *Proc. Amer. Acad. Arts and Sci.*, and bear date of January 26, 1885. There are four parts, as follows: I. A revision of some Borragineous genera. II. Notes on some American species of *Utricularia*. III. New genera of Arizona, California and their Mexican borders, and two additional *Asclepiadaceæ*. IV. *Gamopetalæ* *Miscellanææ*.

In the first section, after a discussion of various structural points, a revision of the *Eritrichiæ* is proposed which suppresses the genus *Eritrichium* (the name however being retained for a section of *Omphalodes*). The species are distributed among the genera *Omphalodes*, *Krynitzkia*, *Plagiobothrys* and *Echidiocarya*. In the second section certain obscurities in connection with the synonymy of species of *Utricularia* are cleared away. In III the new genera are *Veatchia* (*Anacardiaceæ*), *Lyonothamnus* (*Rosaceæ?*), *Pringleophytum* (*Acanthaceæ*), *Phaulothamnus* (*Phytolaccaceæ*), represented by an interesting but uncomely shrub (*P. spinescens*) from N. W. Sonora, *Himantostemma* (*Asclepiadaceæ*), and *Rothrockia* (*Asclepiadaceæ*), the last dedicated to "my friend and former pupil, Dr. J. Trimble Rothrock, professor of botany in the University of Pennsylvania, at Philadelphia, a keen botanist and zealous teacher, an explorer both in Alaska and Arizona, author of a sketch of the Flora of Alaska, and of the botany of Wheeler's report upon the U. S. Surveys of Arizona and Southern California, and whose name it is well to commemorate in an Arizono-Mexican genus."

In Section IV the most important accession of species is a second *Schweinitzia*, viz., *S. reynoldsia*, discovered by Miss Mary C. Reynolds near St. Augustine and on the Indian river, Florida.—*Charles E. Bessey*.

BOTANICAL NOTES.—The second number of the *Bulletin* of the Washburn College Laboratory of Natural History (Topeka, Kansas) contains descriptions of a number of new species of fungi, among which are two *Phalli*, viz., *Phallus collaris* and *P. purpuratus*, the first illustrated by several figures. *Simblum rubescens*, the curious plant of abominable odor and strange distribution, first described by Gerard in the *Torrey Bulletin*, is recorded as common in Shawnee county. The Kansas form is set off (with-

out sufficient reason, as it appears to us) as the variety *kansensis*. *Lycoperdon rubro-flavum*, *L. sigillatum*, *L. rima-spinosum*, *L. tabacinum* (the last by J. B. Ellis) and *Geaster turbinatus* are other new species of Gasteromycetes. Lists of ferns, mosses, lichens, algæ and parasitic fungi complete this very interesting bulletin. —Part II of the Catalogue of Canadian Plants, by John Macoun, is a thick pamphlet of about 200 pages, devoted to the Gamopetalæ. Curiously the number of species in this part (908) is almost exactly the same as in the previous one, viz., 907. There is a great deal of exceedingly valuable information given upon the geographical range of species, and also much in the way of notes upon habitats. —Dr. Gray's memorial of George Benthall in the *American Journal of Science* for February, contains one of the fullest accounts of the very full life of the venerable botanist, whose death the world still mourns. "His life was a perfect and precious example, much needed in this age, of persevering and thorough devotion to science while unconstrained as well as untrammelled by professional duty or necessity. For those endowed with leisure, to 'live laborious days' in her service, is not a common achievement." —Nos. 1 and 2 of the *Journal of Mycology* have been received, and we can only say at this time that the matter is, in the main, good, but that the editor has not yet succeeded in getting from his printers as good work as is desirable. This, however, will doubtless be improved in the future.

ENTOMOLOGY.

GENERIC POSITION OF *POLYDESMUS OCELLATUS*.—In a letter to Professor Packard the undersigned writes as follows :

In the AMERICAN NATURALIST, April, 1883, you have published a paper on "a new species of *Polydesmus* with eyes," which you have called *Polydesmus ocellatus*. As can be seen from your description given there, the new myriopod must be a species of the genus *Craspedosoma* Leach (Transac. Linn. Society, Vol. XI, p. 380, printed 1815), and not of the genus *Polydesmus* Latr.; for the latter genus is always characterized by the want of eyes and by the number of segments being twenty, whereas the former genus is characterized by oculi composed by multiserial ocelli and by the number of segments being thirty or, in younger specimens, less, from twenty-seven to twenty-nine.

In consequence of the necessity of ranging your species in another genus, all the members of which are provided with eyes, the specific name *ocellatus* should be removed and another introduced instead of it. I propose the name *Craspedosoma packardii*.

As I have reason to suppose, you are probably not in possession of Dr. Fr. Meinert's paper on the Chilognatha of Denmark (Danmark's Chilognather, published 1868 in the Naturhistorisk Tidsskrift, 3 Række [= series], 5th Vol.), where the genera *Poly-*

desmus and Craspedosoma are very well defined. The characteristics given by that excellent author are, in extenso, as follows:

"*Polydesmus*.—Mandibulæ pectinibus senis, pro dente molari lobo fimbriato instructæ. Lamina labialis maxima, tertiam partem stipitum labialium et maxillarum sejungens. Stili linguales bidentes. Oculi nulli. Antennæ articulo penultimo brevior quam primo; tertio longissimo, longior quam sexto. Stigmata odorifera in segmento 5, 7, 9, 10, 11, 13, 15-19 sita. Segmenta strictura transversa partita; pars posterior lateribus valde explanata. Segmentum 2-4 singulo pare, cetera segmenta binis paribus pedum instructa; numerus segmentorum 20. Sterna duo prima libera; cetera per paria inter se et cum segmentis suis concreta. Segmentum secundum et tertium infra clausa. Pedes omnes 6-articulati; articulus ultimus longissimus, longior quam tertius. Valvulæ anales valde convexæ. Corpus non contractile. Mas: Par prius pedum segmenti septimi in organa copulationis prominentia conformatum. Paria pedum 30. Femina: Paria pedum 31.

"*Craspedosoma*.—Mandibulæ pectinibus denis; dente molari magno. Lamina labialis magna, tertiam partem stipitum labialium modo sejungens. Stili linguales tridentes. Oculi ocellis multiserialis. Antennæ articulo penultimo longior quam primo; tertio longissimo, longior quam quinto. Stigmata odorifera nulla. Segmenta strictura transversa partita; pars posterior plus vel minus dilatata. Segmentum secundum, tertium ultimumque pediferum singulo pare cetera segmenta binis paribus pedum instructa; numerus segmentorum 30 vel minor. Sterna omnia libera. Pedes primi et secundi paris 6-articulati, ceteri 7-articulati; articulus pedum quartus longissimus, longior quam ultimus. Valvulæ anales angulatim convexæ. Corpus in turbineum vel spiram contractile. Mas: Segmentum sextum leviter, septimum valde efflatum. Utrumque par pedum segmenti septimi in organa copulationis oblecta conformatum. Paria pedum 48 vel pauciora. Pedes, paribus primo, secundo ultimisque exceptis, articulo ultimo dense pulvillato. Femina: Paria pedum 50 vel pauciora."

If you should wish, for comparison, specimens of the Swedish *Craspedosoma ravalinsii* Leach, I request the honor of receiving your orders, and immediately some individuals will be sent to you.—*Dr. Anton Stuxberg, director of the Zool. Mus. of Gothenburg, Sweden.*

[We have delayed publishing this note hoping to receive the specimens of *Craspedosoma*, in order to ascertain whether we have made a mistake in referring the myriopod to *Polydesmus*, but thus far it has not been received.—*A. S. P.*]

AQUATIC CATERPILLARS.—*Apropos* of our article on the habits of the aquatic caterpillar of *Hydrocampa* in the *NATURALIST* for August last, we copy the following account of one of the same group of Pylalids from the Journal of the Royal Microscopical Society for December:

W. Müller-Blumenau has examined *Cataclysta pyropalis*, the larvæ of which live in water, but do not resemble the only known example, *Paraponyx stratiolata*, in the same way of breathing by gills. The larva, which is 1.4^{cm} long, has a flattened body, attenuated posteriorly. The gills are in the form of unbranched tubular appendages of the second and third thoracic and of all the abdominal segments; they are arranged in an upper and a lower group; the number of gills varies somewhat. The stigmata of the tracheal system are, as a rule, all closed, but are easily to be dis-

tinguished by a black oval dot; just as in other larvæ with tracheal gills, as described by Palmén, the stigmatic branches are completely closed. The larvæ are ordinarily found attached to stones, and are rather more frequent in stagnant than in running water. They form for themselves a chamber with delicate but closely spun walls, and they do not leave this, as a rule, until they attain to the imaginal state. The spaces at the edge of the cocoon only serve as a means of exit for the fæces; they live on the diatoms and other cellular Algæ which grow on the stones to which they attach themselves. They almost always fix themselves by their backs to the stones, and in correlation with this we observe that they present the remarkable condition of having their dorsal surface pale, and their ventral dark. This is not however, to be regarded as a protective adaptation, but as the result of an earlier condition in which the whole of the larva was darkly pigmented; the paleness of the back is due to the want of light.

After an account of the pupa and of the homes in which it dwells, the author passes to some other species of the same genus, all of which are Brazilian. These are much less common, and their specific characters are not yet fully worked out, but there are probably five species. The gills, which are always unbranched, never attain to the relative length seen in *C. pyropalis*, but they are always more numerous. The covering of the pupa contains air-spaces in its outer division, which are connected with that of the inner, but as the stones or algæ forbid any exchange of gas with the exterior, this can only be effected by the spaces in which the water is able to pass; this explains how it is that we sometimes find the air-chambers on the side of the house which is attached to the stone.

ORGANS OF HEARING AND SMELL IN SPIDERS.—F. Dahl proposes to classify spiders according to the character and disposition of the auditory hairs on the limbs of these animals, as follows:

1. Tibia with two series of auditory hairs, metatarsus with one hair, and tarsus with a rudimentary pit or depression free from hairs, *e. g.* Epeiridæ, Uloboridæ, Theridiidæ, and Pholeidæ.

2. Tarsus with no rudimentary depression for auditory hairs, usually bearing a number of hairs like the metatarsus and tibia, *e. g.* Territelariæ, Dysderidæ.

The remaining number of this class are further subdivided according to the presence of one or two series of auditory hairs on the tarsus. A single series is characteristic of Amaurobiidæ, Agalenidæ, Philodromidæ, Thomisidæ, and Attidæ. Two series occur in Drassidæ, Anyphoenidæ and Lycosidæ.

Dahl has satisfied himself that these auditory organs can appreciate not only sound, but also variations of atmospheric pressure, such as winds.

An olfactory organ is stated to exist on the maxillæ. On the surface in front of which the mandibles work to and fro is a soft

flat track, of a sieve-like appearance, beneath which occur a number of long, polygonal processes, apparently fused, but in reality separate, which are in connection basally with a stout nerve-filament. Rather by a process of exhaustion than from direct evidence as to their function, Dahl affirms that this organ is olfactory in nature. It is universally found in the Arachnida, though in different stages of development, being most fully developed in Pachygnatha.—*Journ. Roy. Microscopical Society, Dec.*

IGNIVOROUS ANT.—G. Rafin described a species of ant which he has observed in the Island of St. Thomas, and which he proposes to call *Formica ignivora*. A large fire of wood having been kindled at a certain distance from the ant-hill, he is able to affirm that the ants precipitated themselves into it by thousands, until it was completely extinguished.—*Journ. Roy. Microscopical Society, Dec., 1882.*

ENTOMOLOGICAL NOTES.—In a paper on the larvæ and larval cases of some Australian Aphrophoridæ, F. Ratte describes those of a species probably of *Ptyelus*, which are true shells, containing at least three-fourths of carbonate of lime, and resembling in shape some fossil and recent serpulæ, some being conical, others serpuliform or helicoidal. The conical shells are fixed on the branches of some species of Eucalyptus, the mouth turned upwards, the larva being placed in it with the head downwards.—In his notes on the flight of insects, Dr. v. Lendenfeld contests the views of the French physiologists that the position and movements of the wings of insects are merely the results of the mechanical influence of the resisting air, and gives instances where muscular contraction had been clearly proved.—Dr. S. W. Williston begins, in the Bulletin of the Brooklyn Entomological Society for February, a series of papers on the classification of North American Diptera. The first paper is extracted from a monograph of the North American Syrphidæ, now ready for the press, and which gives the results of a careful study of nearly 275 species of this family.—The committee on a union of *Papilio* with the *Bulletin* have reported in favor of it, and recommend that a monthly journal be issued under the name of *Entomologica Americana*, at \$2 a year.—An entomological society has been established at Newark, N. J.—In an examination of over 1500 specimens, Mr. C. H. T. Townsend found 115.3 males to every 100 females (*Can. Ent.*, Dec., 1884).—Mr. W. H. Edwards recounts, in the *Canadian Entomologist* for December, further experiments upon the effects of cold applied to chrysalids of butterflies.—*Nature* for Jan. 29, gives good figures and descriptions of the two fossil scorpions from the Silurian of Sweden and Scotland lately discovered.—A writer in the same number claims that the leaf-eating ant has something to do with the barrenness of the pampas of the La Plata, as they defoliate Eucalyptus plantations, cutting off the first leaves.

ZOOLOGY.

THE ANATOMY OF THE HIRUDINEA.—Mr. A. G. Bourne (Quart. Journ. Mic. Sci., July, 1884) contributes the results of observations upon ten genera of Hirudinea extending over a period of four years. His conclusions with regard to the vascular system are, that the whole of the vessels and sinuses are in continuity; that the lateral vessels communicate freely with one another without the intervention of any capillary system, that they possess branches opening into botryoidal or other capillary networks of the "cutaneous" system, and that they form nephridial capillaries and also capillaries upon the intestinal wall. The nephridial capillaries are partly collected again and carried to the capillaries of the cutaneous system, and partly unite to form a vessel which is connected with the perinephrostomial sinus. The dorsal sinus is directly connected with the ventral sinus, and both communicate with: (1) The cutaneous networks; (2) the capillary network upon the walls of the crop; (3) the capillaries upon the intestinal wall and the spiral valve; (4) the perinephrostomial sinuses. The botryoidal and other cutaneous capillary networks communicate with branches of the lateral vessel, and also with the extensions of the dorsal and ventral sinuses, of which the capillaries on the walls of the crop are developments. The vessels of the walls of the gastro-ileal tube are directly derived from branches of the lateral longitudinal vessels; the ventral sinus contains the nerve chain, the perinephrostomial sinus contains the nephridial funnel, and the network of capillaries on the testicular wall potentially contains the testis. The lateral vessels and their branches have a definite muscular wall, wanting only on their smaller branches and capillaries, but the dorsal and ventral sinuses, and the extensions in connection with them, containing organs, or forming a complete network around organs, have no muscular tissue in their walls. These latter, therefore, represent the "coelom," while the lateral vessels and branches represent a vascular system which has not become quite closed.

The writer leaves unsettled the vexed question of the relationship of the leeches to other Vermes, but appears on the whole more inclined to approach them to the Platyelminths than to the Chætopoda.

NEUMAYR'S CLASSIFICATION OF THE LAMELLIBRANCHS.—Neumayr (Sitz. k. Akad. der. Wiss. Wien, 1883) gives a new classification of the lamellibranchs, founded upon the hinge. The oldest forms have no, or only the faintest, trace of hinge-teeth, the shells are thin, and there is usually neither mark of muscle or of pallial sinus. For these forms, supposed to have two equal adductor muscles and an entire mantle-line, the order Palæonchæ is proposed. From these are supposed to diverge the Desmodonta, without hinge-teeth or with irregular hinge-teeth, with

two equal adductor muscles and with a pallial sinus; and the Taxodontæ, with numerous undifferentiated teeth and two equal muscles. To the first of these groups belong the Pholadomyidæ, Corbulidæ, Myidæ, Anatinidæ, Mactridæ, Paphidæ, Glycimæridæ and Solenidæ?, and to the second the Arcidæ and Nucalidæ. The Tubicolæ form a suborder of the Desmodonta. From the Taxodonta branch off in one direction the Heterodonta, with distinct cardinal and lateral teeth fitting into each other and two muscle-impressions (Najadæ, Cardinidæ, Astartidæ, Crassatellidæ, Megalodontidæ, Chamidæ (Rudistes) (Tridacnidæ), Erycinidæ, Lucinidæ, Cardiidæ, Cyrenidæ, Cyprinidæ, Veneridæ, Gnathodontidæ, Tellinidæ, Donacidæ), and in another, the Anisomyaria, with irregular or no hinge-teeth, two unequal muscles or one only, and no pallial sinus. These form two suborders, Heteromyaria (Aviculidæ, Mytilidæ, Prasinidæ, Pinnidæ) and Monomyaria (Pectinidæ, Mytilidæ, Spondylidæ, Anomidæ, Ostreidæ). The Trigonidæ are considered a suborder of Heterodonta.

ANTENNARY GLAND OF CYTHERIDÆ.—W. Müller-Blumenau has discovered that *Elpidium brossliarum* is able to secrete a sticky material while in water; the observations made in connection with this discovery led him to the belief that the animal was able to spin, and that the spinning organ was placed in the second pair of antennæ. The organ so well known to be present at the base of this pair of appendages has been supposed to be poisonous in function, but no direct observations have ever been made in support of this view, and it is opposed by the delicate nature of its flagellum, which could never be supposed to be capable of inflicting a wound. When the animal is found hanging to glass its anterior end is always nearest to the glass, and the creature takes an oblique position. The author points out the difficulties presented by the habits of the animal in determining the question which he has investigated, but it would seem to be certain that the antennary gland is possessed of the power of secreting an attaching thread.—*Journ. Royal Microscopical Society, Dec.*

AN EYELESS EEL.—Some years ago a very aristocratic house at Elizabeth was deserted because of the belief that it was haunted. Not long ago it passed into new hands. An old well was then uncovered, and the bottom cleaned. In doing this an eel (*Anguilla rostra*) some fourteen inches long and pretty thick for its length, was brought to the surface. It was quite blind, and in appearance to the ordinary observer was even eyeless. My wife and one of my sons saw it, and such was their opinion.—*S. Lockwood.*

TEMPERATURE AND HIBERNATION.—In the January NATURALIST (p 37), was an interesting article on the hibernation of the lower vertebrates. The author referred to hibernation as being in some

cases a voluntary act. Some of the observations on animals confined in our laboratory for the purpose of study, may throw more light on this subject. These animals are all well known species, and our aim is usually to keep them in surroundings as nearly like their natural habitations as possible. The temperature cannot, in the single room at present devoted to this use, be kept at a degree which will suit the habits of all of them, but the effects of its change on each is noted.

A number of frogs (*Rana halecina*) were placed in a closed glass case, with growing plants to study the balancing effect of their respiration. Plants and frogs seemed to thrive excellently, and during the four months trial, the temperature being kept at about 70° F., the latter showed no evident signs of hibernation, though the case stood in front of a window against which the snow was often falling. To observe the effect of a lower temperature, the case was moved to a cooler place (40°), and immediately the frogs, *using their front legs like dogs*, dug under the moss and stones, and remained out of sight until the former temperature was renewed. Similar experiments tried with salamanders, snakes, toads, houseflies and hornets, revealed at once a desire to hide during the lower temperature, but a complete absence of any such tendency when the normal degree of heat was preserved. In every one of these cases and a number of others, hibernation seemed to be forced. If the temperature was lowered, and they were at the same time prevented from burying themselves, they gradually became stiff and lifeless, but could in every case tried, except the last two mentioned above, be resuscitated upon the application of heat.

During this last fall a scorpion, shipped from the South in a bunch of bananas, was subjected to like treatment with the same results. When cold it was so helpless that it could be handled with impunity; but when its box was placed near the fire, it would dart about with elevated tail in the manner peculiar to itself.

With some of our animals experiments have given different results. A wood-tortoise, though given a warm corner near the fire, could not be persuaded to pass the winter above ground. It exhibited very evident signs of uneasiness as the snow came, and, as soon as material was furnished, burrowed out of sight. The same was true of a number of crayfish in our collection.

Not the least interesting among our pets is a pair of opossums (*Didelphys virginiana*). This animal is popularly believed not to go into winter quarters in this latitude; experiment thus far has shown that they remain in a semi-dormant condition, and take no food—a remarkable fact for opossums, when the conditions demand inaction. Their den was placed by a window on the north side of the building. Their food has remained untouched for more than a fortnight, and when viewed from the inside of the

window they are found to be curled up together in their straw nest. It may be that in this case "possuming" is only another word for hibernating.

All of our experiments lost a part of their value because the animals are in confinement; but, with the two exceptions given above, where habit controlled, all seemed to prove that hibernation is not an inherited and peculiar trait, but one that may be adopted when the conditions demand it. The NATURALIST shall hear of our further work in this direction.—*W. W. Thoburn (Laboratory of Illinois Wesleyan University).*

THE CHAMELEON VIVIPAROUS.—According to the newspapers a United States vessel recently arrived at Brooklyn which had taken on some animals at Capetown, Africa, among these was a female chameleon which during its passage gave birth to eleven young ones, all of which died.—*S. Lockwood.*

A CROW CRACKING CLAMS.—My son-in-law assures me that years ago it was not so rare to see, at Port Monmouth, the common crow (*Cervus americanus*) take a quahog (*Venus mercenaria*) up high in the air and drop it on a certain fence with a flat top-rail, thus cracking it. The sight has been witnessed by several persons. He was not able to say *how* the bird carried the bivalve, but it is supposable in its claws. It must have required nice calculating certainly.—*S. Lockwood.*

THE TURKEY BUZZARD BREEDING IN PENNSYLVANIA.—On May 20, 1882, I visited a "nest" of the turkey buzzard (*Cathartes aura* Illig.) in the lower part of Chester county, Pa. The locality was a deep wood bordering upon one of the tributaries of the Brandywine; the eggs, two in number, were deposited under a low, shelving rock, on the bare ground. The female bird was setting when I approached, but immediately flew off uttering a harsh "squak" and discharging a mouthful of carrion. She lit upon a dead tree near by, and remained there with her wings extended watching me. The male bird circled about over the wood but did not alight.

On May 22d of the same year I found another pair breeding in a similar situation on the farm of Mr. T. Dutton Steele, in East Bradford township, Chester county. The eggs in this case were laid on the ground at the foot of a large rock; they were longer than the others and not so thickly marked.

Several other "nests" were found during the same season, and in one instance the eggs were deposited in an old stump. The eggs were dirty white, spotted irregularly with reddish brown and purple.—*Witmer Stone, Germantown, Pa.*

A BEAVER DAM BUILT WITHOUT WOOD.—The idea that the beaver must have wood with which to build his dam is so universal that an exception to the rule seems worthy of record.

In September of 1883, near the headwaters of Beaver river,

Dakota, the writer discovered a dam freshly built of mud, and coarse, marshy plants. No trees or bushes could be seen anywhere in the vicinity. It was about twenty-five feet in length, thrown across a sluggish stream about half that width. Its level top was about four feet higher than the bottom of the channel. The dam was not more than half-filled with water.—*J. E. Todd.*

THE WILD HORSE OF THIBET.—The celebrated traveler, Przevalsky, on his return from his third great journey in Central Asia, brought to St. Petersburg an example of a new species of *Equus*. This was described in 1881 by Mr. J. S. Poliatow as *E. przewalskyi*. It has warts on its hind-legs as well as on its fore-legs, and has broad hoofs. These characters ally it to the true horse, but the long hairs of the tail do not commence until about the middle of that appendage. It is thus intermediate between the horse and the asses, to which category the other known wild species of *Equus* belong. Its mane is short and erect, there is no forelock, and no trace of a dorsal stripe. The stature is small, the legs very thick and strong, the head large and heavy, and the ears smaller than in the asses. In color, it is whitish gray, paler and whiter beneath and reddish on the head, and on the upper part of the legs, which are blackish from the knee downward.

Przevalsky's wild horse inhabits the great Dsungarian desert between the Altai and Tianschan mountains. The Tartars call it "Kertag," and the Mongols "Statur." It goes in troops of from five to fifteen, led by an old stallion. It is lively, very shy, with sight, smell, and hearing well-developed, so that it is exceedingly difficult of approach. It seems to prefer the saline districts, and to be able to do without water for long periods. Thus it can only be hunted in the winter, when melted snow can be obtained. Przevalsky only met with two herds during his whole stay in the desert. The only specimen brought to Europe is in the museum of the St. Petersburg Academy of Sciences.

ZOOLOGICAL NOTES.—*Sponges.*—Professor W. S. Sollas has recently studied the development of *Halisarca lobularis* from specimens obtained at Roscoff. Schulze, whose specimens were taken in the Mediterranean, found that the development of the young within the parent sponge did not proceed further than the formation of the blastula, or at most of an incipient gastrula; whereas in those observed by Sollas the embryo became much developed within the parent, and the blastula stage was slurred over, apparently to economize space. No segmentation cavity was observed, but directly a cavity was necessary, the loosely aggregated cells of the morula packed themselves closely together to form the wall of the unfinished blastula, leaving their overplus in the interior in irregular heaps which subsequently arranged themselves into a unicellular layer along the line of the infolding wall of the gastrula. Professor Sollas attributes the

difference in development between the Mediterranean and Roscoff specimens to the difference of conditions, the former sea being without heavy tides and powerful currents, so that the larvæ can safely issue into the water at an early stage.—Dr. Sendenfeld claims, in *Zool. Anzeiger*, Jan. 26, to have discovered a scattered system of mesodermal nerve-cells in several kinds of sponges.

Mollusks.—After a study of the morphology of *Rhabdopleura* from specimens obtained at Lervik, near Bergen, Norway, Professor E. R. Lankester does not decide whether the form is polyzoon or molluscan, but inclines to the view that both it and *Cephalodiscus* are degraded lamellibranchs. The colony consists of branching tubes, built of a series of rings, each of which is separately secreted and added to its predecessors by the so-called buccal shield or pre-oral lobe of the polypide. A completed branch ends in an upstanding polyp-tube, while in a growing branch the axis runs beyond the last erect polyp-tube. The axial tube is divided by septa into segments, one corresponding to each polyp. When a bud reaches a certain stage of development it breaks through the wall of its chamber and grows outwards at a sharp angle. Occasionally it atrophies, leaving a sterile chamber. The buccal shield or disk is locomotive as well as secretive, and is covered with fine cilia, which occur also on the lophophoral filaments of the arms right and left of it. In the center of the ringed caulotheca or tube is the axial stalk which connects and bears the polyps. This is soft in the polypides, hard on the stem, but every hard portion is formed by the shrinkage of the soft stalk and the development of a cuticle. An internal skeleton exists in the lophophore and in the axis. The embryology of this curious form is as yet unknown, nor is it known whether the sexes are distinct or the colony persistent from year to year.—More *Pleurotomidæ*. Mr. E. A. Smith describes (*Ann. and Mag. Nat. Hist.*, Nov., 1884) thirty additional species of this group.—In the same magazine (Oct.) Dr. R. Bergh has a paper upon the affinities of *Onchidia*. After an examination of the structure of various organs, the writer arrives at the conclusion that "the *Onchidia* agree with the *Pulmonata* in the structure of the nervous system, in the existence of a lung and of a parenchymatous kidney, in the presence of a peculiar pedal gland, and in various peculiarities of the generative system. They branch off from the *Pulmonata*; they are *Pulmonata* which have adapted themselves to an amphibiotic or marine mode of life."

Crustaceans.—Among new forms of *Crustacea* dredged by the *Albatross* in 1883, are an ally of *Ethusa*, taken in 1496 to 1735 fathoms, a species of *Galacantha* M. Edwds., in 1479 fathoms, two forms of *Pentacheles*, between 843 and 1917 fathoms, *Notostomus*, a *Palæmonid*, six inches long and of an intense dark crimson, in

1342 fathoms; three species of a new genus allied to *Pasiphaë* and also to *Hymenodora*; a Penæid of the genus *Aristæas*, a foot in length, and a large *Sergestes*, three inches long. The size of these new shrimps is remarkable, but is greatly exceeded by that of some of the deep-sea crabs. Thus the great spiny *Lithodes agassizii* has a carapace seven inches in length and six in width, and measures above three feet over the outstretched legs.

Arachnidans.—The development of *Chelifer* differs from that of other arachnids in the existence of a larval state as yet little known, and the structure of which has been found by M. J. Barrois to be more complicated than was stated by Metschnikoff. The number of pairs of feet is five. The nutritive vitellus is surrounded by a layer of exodermal cells preceded by an ample organ of suction opening on the ventral aspect between the two large claws (second pair). The whole forms a digestive apparatus destined to pass nutritive material into the interior of the larva. The larva is fixed upon the ventral face of its mother, and subsists parasitically upon her. The sucking apparatus is destined to fall, and its mode of elimination is singular. In the earlier stage the ventral nervous band consists of two parts, one in front of, the other behind the sucking organ. Afterwards, when the two bands are united into a continuous cord, the sucking organ is thrust outwards, becomes attached only by a thin cord below the definitive mouth, and falls at the same time with the larval envelope.

Fishes.—Karl Mobries, in a letter to *Nature*, maintains that flying fish are incapable of flight "for the simple reason that the muscles of their pectoral fins are not large enough to bear the weight of their body aloft in the air." The pectoral muscles of birds weigh on an average $\frac{1}{8}$ of the total weight of the body, those of bats $\frac{1}{13}$, those of the flying fish only $\frac{1}{32}$. The impulse is given while still in the water by the powerful masses of muscle along the sides of the body, masses which are larger than in any other fishes of similar size. The flickering motion which has been noticed is only a vibration of the elastic membrane of the pectorals, which occurs whenever the fins are in a horizontal position parallel to the wind.

Birds.—M. de Quatrefages (Ann. and Mag. Aug., Sept. 1884), ably maintains against Dr. Haast, the belief that the final extinction of the various species of moa formerly inhabiting New Zealand is due to the Maoris, and not to the preceding Melanesian natives. The discovery of bones to which the muscles and integuments still adhere, furnishes a proof of this, as do the traditions of the natives. The last moa hunt of which memory is preserved, according to Mr. White, took place near Whakatone, in the Bay of Plenty. The feathers of birds killed there were until recently in the hands of a chief named Appanui.

EMBRYOLOGY.¹

ON THE POSITION OF THE YOLK-BLASTOPORE AS DETERMINED BY THE SIZE OF THE VITELLUS.—This principle, which I have to some extent elaborated elsewhere (*Cont. Embryog. Oss. Fishes*, p. 114), in so far as it applies to the ova of bony fishes of different species, differing greatly in the dimensions of the vitellus, may be expanded so as to throw some additional light upon the growth and closure of the blastoderm of other groups of Vertebrata. In the paper cited I have shown that the position of the point of closure of the blastoderm in relation to the original position of the germinal disk in Teleostei is to a large extent determined by the size of the vitellus, and consequently also stands in an intimate relation to the variation of the area of the vitelline surface over which the blastodermic membrane must grow, that is to say, with the increase of the superficial area of the vitelline globe upon which the germinal disk is superimposed, and over which it spreads as the blastoderm, the position of the yolk blastopore must vary.

A yolk blastopore is met with only in such forms of ova in which there is a distinct, unsegmented or partially segmented vitellus developed. As a rule, it does not coincide with the position of either mouth or anus, but when such a coincidence does occur the yolk blastopore answers nearly or quite to the permanent anus of the Vertebrate embryo. In the Vertebrates the yolk blastopore is apt in most cases to close behind the position of the permanent anus; in large-yolked cephalopod ova it closes at the anterior or perhaps more properly on the ventral face of the yolk-sack, and seems to have no relation to either mouth or anus. This is also the case with the yolk blastopore of the embryo of Sauropsida in which it closes far behind the point where the true blastopore is formed.

In a large Teleostean ovum, as in those of the larger Salmonoids and marine catfishes, the embryo ceases to grow in length when it has extended itself over an arc of the yolk globe of, say, 90° to 125° ; in *Alosa*, an intermediate form, it extends its growth through an arc of 180° on the surface of the vitellus; in a third and still smaller type of ovum, that of *Carassius*, it may apparently grow to a greater length, and embrace an arc of 230° on the surface of the yolk sphere. In the first type that part of the rim of the blastoderm not yet incorporated into the body of the embryo and lying behind the latter may be drawn out into an oval, the anterior end of this oval area, over which the vitellus still remains uncovered, lying next the caudal extremity of the embryonic axis so far differentiated, as in *Tylosurus* and *Elacate*. This usually happens when the embryonic axis does not extend over a semicircumference of the vitellus, and when that half of

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the blastoderm opposite the embryo must grow in width more rapidly than the embryonic half in which the embryonic shield is formed.

These different modes of the growth in length of the bodies of embryos of different species of osseous fishes may easily be verified by the observation of the progressive growth of the blastoderm of the living ova, and go far towards reconciling the differences of opinion which have been expressed by different observers as to the growth of the blastoderm over the yolk. It is at any rate evident that the manner in which this is accomplished in one form does not necessarily hold true of another.

It is very significant that two large-yolked types, viz.: the Sauropsida and Elasmobranchii should both have the embryo displaced in position in reference to the margin of the blastoderm. In the latter, the first traces of the embryo have the normal marginal position at the periphery of the blastoderm, but it is soon folded off, and before the yolk blastopore has closed, the latter finally closing a little way behind the stalk connecting the embryo and yolk sack. In the Sauropsida as held by Balfour, the primitive streak apparently represents the linear thickening between the lower vitelline stalk and the point where the blastoderm finally closed in the Elasmobranchii.

It is thus made evident that, whereas the embryonic axis in Teleostei, Chondrostei, Ganoidei, Petromyzon and Amphibia extends back to the point where the yolk blastopore closes, in Sauropsida and Elasmobranchii, the embryo is partially folded off, and the tail begins to bud out before the vitellus is included by the blastoderm, and while the end of the axis of the embryo is still remote from the opening of the yolk blastopore. This contrast between the two types, as will be evident to the thoughtful person, must be due to the great difference between the bulk of the yolks in the two cases. In the large-yolked forms if the embryonic axis were to continue to grow in length and extend quite to the point where the yolk blastopore closes, the body of the embryo would necessarily develop more somites than are present in the adult, so that growth in length of the embryonic axis ceases in the large-yolked forms far short of the point of closure of the blastoderm, covering perhaps only 30° of arc or less of the entire circumference of the vitelline globe. Such a small segment of the circumference of the vitelline sphere when contrasted with 90° – 125° , and on up to 180° to 230° , embraced by the primary embryonic axis in Anamniote forms, seems inconsiderable, but is really relatively as extensive as in the latter.

The germinal disk of Sauropsida is relatively much larger than that of Teleostei, so that proportionally it probably does not spread over a much larger vitelline surface in the first case than in the last in order to include the vitellus, but as the blastoderm spreads in either case, it must be obvious to any one conversant

with the mode in which the embryonic axis is formed during vertebrate development, that in the former growth in length of the axis would necessarily be completed before the blastoderm could spread over and include the yolk. Those forms of vertebrate embryos in which either the true or the yolk blastopore marks the end of the embryonic axis before the appearance of the tail bud might be called *teleporous*, while those in which there is no such coincidence, the yolk blastopore closing some distance behind or remotely away from the end of the embryonic axis, might be called, *ateleporous*. The first would include Amphibia, Petromyzon, Ganoidei, Chondrostei and Teleostei, the last, Elasmobranchs and Sauropsida. The ova of the two extremes of the vertebrate series Branchiostoma and Mammalia are yolkless, except those of Monotremata, which are probably ateleporous, simulating the Sauropsida in the general features of the development of the blastoderm and early phases of the embryo.

The band of tissue from the vitelline end of the umbilical stalk to the edge of the blastodermic rim in Elasmobranchii, and the primitive streak in Sauropsida and Mammalia are probably homologous structures. In the first instance it is formed by the concrescence of the margin of the blastoderm as it advances over the surface of the vitellus. In the Teleostei, Ganoidei¹ and Chondrostei it would seem that the whole of the margin of the blastoderm was used up by a process of concrescence to form the embryonic axis, whereas in the Elasmobranchii and Sauropsida there is a portion of the rim of the blastoderm remaining behind the embryo, which is not utilized in this way, but remains as the linear thickening of the former or as the primitive streak of the latter. While concrescence is not possible in the course of the development of the Sauropsida in the way in which it occurs in Ichthyopsida, it is known that the primitive streak is related posteriorly on either side to the *rand-wulst* or marginal thickening of the chick's blastoderm, a structure obviously homologous with the lower layer of the thickened margin of the blastoderm of the

¹I regard the development of the germinal disk, embryonic axis and blastoderm of this type as being in no essential respect different from that of the Teleosts. The statements of Balfour and Parker, to the effect that the vitellus undergoes partial segmentation will probably be found to rest upon observations based upon material in which cracks were produced in the vitellus by reagents before the material reached their hands. The later stages show that I am right in this, the vitellus maintaining a relation to the body and intestine of the embryo quite like that observed in osseous fishes and totally unlike that noticed in the meroblastic ovum of Amphibians or Myzonts.

I am also unable to reconcile the figures given by Salensky and Professor W. K. Parker, of the fore part of the yolk-sack of the embryos of Acipenser. If the figures of the latter are correct, which they probably are, the intestine does not enclose the vitellus as represented by Salensky, but passes as a closed tube over the top of the yolk just as in Teleostean embryos, the development of the sturgeons in this respect, it will be seen, differs but slightly from that of bony fishes, a conclusion which is also supported by the way in which the yolk disappears as well as by its position in relation to the body of the embryo.

fish embryo. It is therefore interesting to note that an actual concrescence from behind forward of this *rand-wulst* or lower layer or a proliferation of cells from behind forwards would not be impossible. The *inner mass* of cells of the Mammalian ovum while in the vesicular or blastodermic stage is evidently in part homologous with some part of the thickened rim of the blastoderm of lower forms.

It is also a matter of great interest in this connection to observe that in the Sauropsida the *rand-wulst* or germinal wall is not carried along with the extreme edge of the epiblastic stratum quite to the border of the blastoderm all round as in Ichthyopsida. The epiblastic layer of the blastoderm in the Sauropsida rapidly extends beyond the lower layer or germinal wall, leaving it more or less remote from the outer margin of the germinal area. This peculiarity of development alone would be sufficient to cause the embryo to be formed away from the margin of the blastoderm in the Sauropsida, but even this I venture to suggest is to be explained by the increase in the size of the yolk of the ova of Sauropsida, the connecting link between the latter, and the teleporous Teleostean ovum being supplied by that of the Elasmobranchs, which probably represents at least one of the steps by which the evolution of the blastoderm of Sauropsida and Mammalia was attained, although it would obviously be incorrect to assume that these stages of blastodermic evolution were indicative of a serial or successional affiliation through descent. It would probably be much more rational to regard the development of these differences as being in the main due to an increase in the volume of the yolk as urged by Balfour, and that the causes of variations in its development were therefore to some extent mechanical in character.

The yolkless vesicular blastoderm of the higher Mammalia, or Eutheria, is obviously, as was supposed by Balfour, one which is to be regarded as having been derived from that of the Sauropsida. But no yolk blastopore is ever formed in the mammalian blastodermic vesicle, unless the blastopore of Van Beneden can be regarded as such. The blastopore of Van Beneden is obviously not the true blastopore, and if it can be regarded as representing the yolk blastopore, which seems very probable, the *inner mass* of cells finally involutioned on its closure or covered over by the epibolic growth of the epiblast, and from which mass the mesoblast and hypoblast are derived, that mass becomes homologous with the marginal lower layer or *rand-wulst* of such a type as the Teleostean ovum.

The degeneracy of the vitellus of the ovum of Mammalia may possibly be due to the development of the so-called *uterine milk* from the uterine glands by which the egg is nourished from without during a very early stage and before the development of the *area vasculosa* or the vessels of the allantois is accomplished.

Intracellular digestion and growth is probably accomplished by some of the cells of the epiblast of the blastodermic vesicle, which send out pseudopodal processes between the cells of the uterine epithelium, as described by Caldwell in the case of the blastoderm constituting the yolk bag of the embryos of certain Marsupialia. Viviparity has not affected the development of the vitellus in the Teleosts, *Gambusia*, *Zoarcis* and *Embiotocidæ*, where foetal development is either intrafollicular or intraovarian. An albuminoid secretion is said by Blake to be found in the temporarily closed gravid ovaries of Embiotocoid fishes (*Journ. Anat. and Physiol.*, 11, 280), and in this family as well as in some of the viviparous Elasmobranchs, it seems certain that the young developing viviparously are larger than can be accounted for by the size of the vitellus of the recently fertilized egg of the same species.

It therefore seems conceivable that the Mammalian vitellus, like the ambulatory, prehensile and other organs of parasitic organisms, may have been atrophied in consequence of the perfectly parasitic connection subsisting temporarily between the maternal organism and the embryo, as was supposed by Balfour.—*John A. Ryder.*

DEVELOPMENT OF THE SPINES OF THE ANTERIOR DORSAL OF GASTEROSTEUS AND LOPHIUS.—The important memoir of A. Agassiz before cited, shows that the spines of the anterior dorsal of the angler and stickle-back develop in distinct diverticula of the epiblast, a diverticulum being formed for each spine into which skeletogenous mesoblast is proliferated from its lower or proximal open end. These diverticula soon become free from the anterior end of the median dorsal fin-fold, the latter, in fact, seems to degenerate or be replaced by these diverticula, the first epiblastic diverticula to be developed are more or less translocated forwards from their original positions, so that in this way these dorsal spines are finally brought to rest on the roof of the skull of the adult, considerably in advance of the point where their development began on the nape of the embryo.

The formation of the singular dorsal appendage of the larva of *Fierasfer* according to Emery¹ is developed in a similar way as a dorsal epiblastic diverticulum, arising from the anterior end of the median dorsal fin-fold. The singular foliar appendages along its sides grow out secondarily. This transitory organ in *Fierasfer* is, however, much more precociously and rapidly developed than the bony, anterior dorsal spines of *Lophius* and *Gasterosteus*; its supporting axis is evidently mesoblastic in origin as in the latter, but degenerates just about the time of the final metamorphosis of the animal into the adult condition.—*John A. Ryder.*

¹Fierasfer. Studi intorno alla sistematica, l'anatomia e la biologia delle specie Mediterranee di questo genere. Reale Accad. dei Lincei. Ser. 3^a, Mem. Cl. di Sci., VII, 1880.

PHYSIOLOGY.¹

FUNCTION OF THE THYROID BODY.—The experiments of Zesas (which appear in *Arch. f. Klin. Chirurg.*, Bd., LXXV) upon the effect of the removal of the spleen and thyroid body, have given interesting disclosures concerning the function of these organs. During the experiments, extirpation of the spleen was alone well tolerated, but removal of the thyroid body was followed by striking manifestations. The animals for two weeks refused nearly all food, were drowsy, walked with tottering gait, and died usually in convulsions. These effects were also manifested in animals which had survived the removal of the spleen, and from which subsequently the thyroid body was removed. In them was also observed an enormous increase in the number of white blood corpuscles. In those animals from which the thyroid body alone was removed, the increase of the white blood corpuscles was not so remarkable as it was in those in which the spleen only had been extirpated. Ablation of the thyroid body produced notable anæmia of the brain and hypertrophy of the spleen.

The lymphatic glands, especially those of the mesentery, were frequently greatly enlarged and filled with black pigment. It, therefore, appears from these experiments that the thyroid body not only has the function of acting vicariously for the spleen, but also plays an important part in regulating the supply of blood to the brain, and may, in fact, be considered as a special organ for this purpose. Zesas decides from his experiments that the removal of the thyroid body is not justifiable (surgically), and his conclusions are strongly supported by the results of this operation performed by Kocher on man for the scrofulous degeneration of the organ.—*Med. News*, Jan., 1885.

THE PLACE OF FORMATION OF UREA IN THE BODY.—MM. Grehant and Quinquaud have recently carried out on dogs a long series of experiments for the purpose of determining what are the urea-forming organs of the body. The difficulty of such work lies of course in the quantitative estimation of urea in so complex a fluid as blood. Poiseulle and Gobley concluded from their own experiments that the blood coming from an organ contained sometimes more sometimes less urea than that entering it. The method of the first named authors, though open to criticism, seems to have been followed by them with great confidence, and considerable uniformity of result. It was briefly as follows: blood was drawn directly from various parts of the venous and arterial systems, and after defibrination was thrown into several times its own volume of strong alcohol. The residue left after evaporating the alcoholic extract to dryness was treated with water; a known quantity of this solution was received in a vacuum and its urea decomposed by a solution of mercury in an excess of

¹This department is edited by Professor HENRY SEWALL, of Ann Arbor, Mich.

nitric acid. Urea is thus decomposed into equal volumes of carbonic acid and nitrogen which were easily estimated.

It appeared from these experiments that the blood of the hepatic veins, splenic veins and the portal vein contains always more urea than the blood of the carotid artery, whence it is concluded that the abdominal viscera are the seat of continuous urea formation.

There was no notable difference in urea content between the blood coming from the head or the different members and that blood which entered those parts.

The chyle mixed with lymph drawn from the thoracic duct after death was always found richer in urea than either venous or arterial blood.

The difference between the urea content of venous and arterial blood was much more marked in animals during the digesting than in the fasting condition. This agrees with the statement of Becker & Voit, who found the excretion of urea much increased during digestion.

It may be said that these observations are difficult to reconcile with the well founded belief that the liver is the principal organ for the formation of urea in the body.—*Fourn. de l'Anat. et Phys.*, 1884, p. 317.

ON THE SPECIFIC ENERGY OF THE NERVES OF THE SKIN.—The underlying facts of Joh. Müller's generalization that the nerves of special sense, as the optic, auditory, gustatory, filaments are endowed with specific energies cannot be disputed. What is meant is that any kind of stimulus whatsoever applied to the optic nerve arouses the sensation of light, every irritation of the auditory nerve gives rise to the sensation of sound, &c. The characteristic quality of these sensations depends not at all upon the peculiarity of the sensory nerve, but is determined wholly by the physiological properties of the nerve cells which receive the sensory impulse.

From the skin, as a sense organ, we receive impressions that arouse in us at least two different kinds of sensations, those of pressure and of temperature, and it is an important question whether the impulses giving rise to these different sensations proceed along identical nerves which reply in a different manner to differences in the quality of the stimulus, or whether the nerves of the skin are functionally differentiated in such a way as to call forth specific sensations without regard to the character of the stimulus. Weber believed that sensations of temperature and of pressure were modifications of the same sense, depending upon the amount of energy aroused in the sensory nerve. Physiological analogy throws doubt upon this interpretation, and recently Blix has produced evidence which supports the view that the various sensations aroused by excitement of the skin are as truly specific and due to the excitement of distinct nerves, as is the case with the other special senses. Blix used as stimulus the faradic elec-

trical current. One electrode was fixed to the skin by a broad moistened contact, while the other electrode, used in exploring the surface, ended in a fine metal point. By graduating the strength of the current, sensory irritation was confined to the region of the pointed electrode. It was found that electrical stimulation of different areas of the skin produced different sensations. At one spot the irritation excited only pain, at another a sense of cold, at a third of warmth, at a fourth, it might be, of pressure. Hence, it may be concluded, that the quality of the sensation depends not on the nature of the stimulus but upon the specific energy of the irritated nervous apparatus.

The author thinks he has shown that sensations of cold and warmth, respectively, are excited through different sets of nerves. The *cold* nerves are broadly scattered over the skin and their endings are rather deeply buried in its substance. The *warm* nerves are distributed to well-defined small areas from which alone we attain sensations of heat. A cold piece of metal, a square centimeter in section, laid upon a certain part of the forearm, produces no sensation of cold, while a pointed instrument of the same metal, at the same temperature, with a contact surface of only half a square millimeter, gives intensely cold sensations when applied to certain parts of the skin in the immediate neighborhood of the insensitive area.—*Zeitsch. f. Biologie*, Bd. xx, p. 141.

PSYCHOLOGY.

INTELLIGENCE OF A SETTER DOG (*Continued*).—It is perhaps proper for me to here refer to the peculiar fancy of the bitch Frank. Barney was always her choice and strange as it may seem—with him there was no reciprocation.

I have tested her pretty thoroughly, and I can say that she has not thus far permitted a dog not her own color to line her. And as a further proof a short time ago, being a few days before her season of heat, she left the farm seven miles distant upon which I had her kept and returned here.

There are numbers of dogs in the neighborhood where she was kept, but she returned and when a dog of different color from her own was offered she would fight desperately. Although kept on the farm for several months this was the only time she had left it.

Experimenting as I have with a number of dogs and bitches, I have noticed that some are very choice in their selection of a mate, while others are not. Some bitches will permit several to line them, even without interval, while others will not have but one serve them. Barney would not serve a wolf, *Canis latras*, but Wad did. As a further evidence for comparison, showing the difference between the likes and dislikes of dogs, I give the following: Frank, as above stated, chooses a mate only of her own color, while Barney's greatest aim is to frolic with and if possible to line a pointer bitch in color nearly white, with a few black spots.

A dog more mischievous or one more noted for his original pranks, I never owned. Many of the little things usually taught a dog were not to his liking, and for this reason would at times bring harsh words upon him, but for originality I have not known his equal.

He had been taught to carry quite heavy loads of shells for me into the field to use in hunting, and in this manner he was much strengthened in his jaws. It was an easy task for him to pick up a twenty-five pound sack of shot and carry it a hundred or more feet. One time he surprised me in this feat, for I had used a sack of shot to tie him to in the office. Frank was also tied to another sack near by. I picked up the sack of shot she was fastened to and led her to another part of the office, to another room. After a few moments Barney came in carrying his sack of shot. I had not intended moving him but this ingenuity was too much in the dog's favor, he was permitted to remain.

While hunting it was a common practice for him to stand in front of me when shooting from a point, stand or blind, and while I could watch all birds that came towards me, he would give me signal by the expression of his eyes and movement of his head from which way I could expect the best shot, and many times I have waited until from his signs it was evident the birds were in close range, then turning around rapidly make a good shot.

In hunting small birds he was exceptionally fine, for when out with me collecting specimens, as I would crawl along closely watching the habits perhaps of some minute bird, he too would walk as stealthily as a cat and many times he has by his cautious actions, a look up into the tree or a wag of his tail, called my attention to one or more birds I had not as yet noticed in the tree under which we were observing.

Before going to Labrador he was a fine retriever—retrieving even a kinglet or the smallest warbler in the most careful manner, but his battles with the many wounded puffins (*F. arctica*), he retrieved while in Labrador, changed him so that it was unsafe to permit him to retrieve a small bird thereafter.

His facial expression was excellent and at no time more interesting than when astonished. At about six months of age I began working him to retrieve small birds in the field, this he did quite nicely upon ground where it was easy for him to find them, but one time the bird fell into one of the deep ravines so common along our western water-courses. Nothing daunted he jumped over the bank and was soon sliding or rolling or running down the side to the bottom; he found the bird and started for the top and was nearing the edge of the level ground when the earth slid out from under him. I was near enough to witness the whole and saw him open his mouth and swallow the bird, and then at once upon getting over his fright, in the greatest astonishment, look around, then at me as much as to enquire where was the bird?

He had no appreciation of the fact that that very small bird could have been swallowed, but as I saw him do it, there was no doubt on my part. For some minutes he labored to find that bird, even going to the bottom of the ravine, and I to change his thought shot another bird which fell into the ravine and was retrieved by him.

Another time when his facial expression was very fine, was at a time when he caught a wounded duck that had fallen near me, and while he had her in his mouth I shot another duck, and this second one also falling very near me and the dog Barney opened his mouth and the bird he had in it flew away. Without taking his eyes off the fleeing duck he watched until she had lighted upon some high land away from the water. The next day I put him to work upon the high land to find the duck, and never did I see him more pleased than when he brought the duck yet alive to me.

To give a statement of all the various strange proceedings of this dog would take too much space, for they are many, but to close I will give what perhaps was his last attempt to outwit me and to gratify his own high intelligence.

While collecting birds and animals in Dakota in the fall of 1883, near the close of the season I shot a muskrat in one of the lakes. Barney went out to where it was, in shallow water upon a sand bar, rolled it over with his foot and came towards me without it. Speaking harshly to him he returned picked up the rat and brought it to me on shore. Going towards camp I signaled him to bring the rat with him; after a few moment she complied, and as he trotted along by my side for some distance in apparently high glee I thought no more about him until I got to camp, then looking around for him I could not find him. After a little while he returned to camp and coming up to me licked my hand. Signaling to him to "bring" he instantly went away and laid down under a wagon. Believing then that he had dropped the rat I took a whip and until I gave him a very severe whipping he would not heed my demand. After he had received sufficient to conquer him he trotted off in the direction we came, and as I watched him saw him go to a bunch of undergrowth a couple of rods from the path I had come in on and there began digging where he had buried it. In a few moments he came trotting to me with the rat in his mouth. I then went to camp and he followed, carrying the rat.

The next morning at the door of my tent I accidentally shot this my best of companions, the dog who had been my assistant and watcher over many thousands of miles, by one of those most dangerous, yet very handy guns, the hammerless.—D. H. Talbot.

AN AFFECTIONATE ANGORA CAT.—A. Espagne gives to the *Revue Scientifique* a story of a half-breed Angora cat of exceeding docility and affection. During about fifteen days of every

year this cat left the house, ignored the calls of its owners, and led a wild life around the neighborhood. At the end of this time it returned, and was demonstratively affectionate. It was particularly attached to the aged head of the household, was always at his side or on his knee during the day, and at night slept at his feet. When he died, the cat mewed in a sad monotone never before heard from her. Four years afterwards a baby, to which the cat had transferred her affection, was taken sick and died. During its illness the cat remained most of the time below the cradle, ate little, and lost the brilliancy of its eyes. On the return of the family from the country the cat lay dying in its accustomed place, and was found dead in the morning. Though age and the cold wave which took the infant's life may have had their share in the matter, it yet seems that sorrow was the immediate cause.

C. Jamelin gives a story of a charitable Angora cat of magnificent presence, but not usually very intelligent. This cat many times brought home a hungry cat as if to obtain food for it, and finally maintained a regular pensioner. The first time the estray was brought, the Angora mewed and jumped around till food was given to it, watched it while eating, and then accompanied it to the door, hastening its departure with a series of light quick pats. The strange cat learned the lesson, and often came again as a visitor but not to stay.

INTELLIGENCE OF TORTOISES.—Anecdotes in the *Revue Scientifique* appear to show that these creatures must be credited with a considerable amount of intelligence. M. Boucard writes of one which lives in his garden, and, when called aloud by its name, Laideron, would immediately run towards the voice with all the speed a tortoise can muster.

The *Testudo mauritanica* of M. Boisse showed even more intelligence, learned to come when called by a hissing sound, followed its master like a little dog; relished caresses bestowed on its head and neck, gave gentle bites to show its affection, and would climb upon its master's boots or pull at his clothes to draw his attention.

ANTHROPOLOGY.¹

EASTERN SUDAN.—Professor A. H. Keane favors us with a most valuable piece of ethnological work on the tribes of Eastern Sudan, at a time when all eyes are turned in that direction (*J. Anthropol. Inst.*, XIV, 91-110). Although the scheme is somewhat lengthy we present it in full, omitting the descriptive portion:

I. BANTU GROUP.

Waganda. N. W. of Victoria Nyanza, from Somerset to Alexandria Nile.

Wa-Nyoro. Between Somerset Nile and Albert Nyanza.

Wa-Soga. East from the Somerset Nile.

¹ Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

Wa-Gamba. East of the Wa-Soga.

Wa-Karagwé. W. of Victoria Nyanza, from Alexandria Nile S.

Wa-Songora. W. of Victoria Nyanza, between Wa-Karagwé and coast.

II. NEGRO GROUP.

Kavirondo }
Kuri } E. of Victoria Nyanza, from the Wa-Soga to Kerewé Is. Speech
Kara } Negro and akin to Shilluk.

Nauda. Nauda uplands, north of Kavirondo.

Masai. Kilimanjaro and west towards V. Nyanza.

Kwafi. W. of Mt. Kenia, N. of Masai.

Shefalu. N. of U-Nyoro, akin to Shilluks.

Madi }
Shulé } Between Lower Somerset Nile and Madi mountains, limited westward by
Laboré } the Bahr-el-Jebel.

Janghey }
Fallanj } Lower Sabat basin.
Niuak }

Bari. Both sides Bahr-el-Jebel, 4°-5° N., limited N. by Shir territory.

Monbuttu. Headwaters Welle r., beyond Egyptian frontier.

Zandeh. S. W. frontier Egyptian Sudan w. The *Niam-Niam* of Nile tribes.

Mittu (Mattu). A-Madi, Madi-Kaya, Abbakah, Luba, N. of Monbuttu.

Bongo (Dor). Upper course of Tondy and Jur rivers to Zandeh.

Shir. Bahr-el-Jebel, 5°-6° N., between Dinkas and Baris.

Rol }
Aqar } Tribes of uncertain affinity along Rol r., east of Bonqus and Mittus.
Sofi }
Lehsi }

Nuer (Byor, Ror). Along lower course of Bahr-el-Jebel, 7°-9° N.

Dinka (Abuyo, Agar, Ajak, Aliab, Arol, Atwot, Awan, Bor, Donjol, Jur, Gak, Rish).
 Along Bahr-el-Jebel and right bank of White Nile, 6°-12° N.

Shilluk (Kwati, Dyakin, Dyok, Roah). Left bank of Bahr-el-Jebel and White Nile,
 9°-12° N.

Dwair }
Ayarr } Unclassed tribes south of the Dinkas, N. E. of Bongos, 7°-8° N.
Mok }
Tondy }
Böt }
Ayell }

Takruri. Gallibat district, Abyssinian frontier (James's "Wild tribes," 30).

Funj. Dominant in Senaar, probably Shilluk, mixed with Arab.

Krej. Headwaters of Bahr-el-Arab, beyond Egyptian frontier.

III. NUBA GROUP.

NUBAS PROPER. *Nuba*, *Kargo*, *Kulfan*, *Kolaji*, *Tumali*. Kordofan, chiefly cent. and south, 11°-13° N.

WESTERN NUBAS { *Fur*. Dominant in Dar-Fur.
 Kunjara. Branch of Fur. Darfur and Kordofan.
 Mattokki (*Kenus*). Asuan to Sebi and Wadi-el-Arab.
 Saidokki (*Mahai* or *Marisi*). Korosko to Second cataract,
 Dongolawi. Dongola, Wadi-Halfa to Jebel Deja near Meroe.
 Danagele. Nubian immigrants into Kordofan and Dar-Fur.

NILL NUBAS
 ("NUBIANS,"
 "BARABRA")

IV. SEMITIC GROUP.

speech

(a)
HIMYARITIC
OR
ABYSSINIAN
BRANCH.

- Dahalaki*. Great Dahalak Is. near Massawa.
- Massuai*. Mixed people of Massawa, Tigré speech.
- Hotumla, Karneskim, Az-Shuma, Dokono*. Mudun (Samhar) coast, about Massawa as far as Aqiq.
- Habab, Bejuk, Mensa, Bogos, Takue, Marca*. Aulseba province, N.E. frontier of Abyssinia inland from Mudun.
- Algeden, Sabderat, Dembela*. Beit-Bibel and Dembela districts, head streams of the Barka and Mareb, W. of Anseba.
- Harrar*. Abyssinian enclave in Somaliland, E. from Shoa.
- Tigré*. Predominant nation in North Abyssinia.
- Amhara*. Predominant in So. Abyssinia, subject to Tigré.

rd by

ISMAELITIC
OR
ARAB
BRANCH.

- Shukrieh, Dobeina, Yemanih*. Lower and Middle Atbara, S. to Senaar.
- Jalin (Jahalin)*. Blue Nile confluence, Khartum, and Senaar, Taka, Kordofan, Dar-Fur and Kaffa.
- Kababish*. W. of Nile, 12°-15° N. and between Obeid to the Nile at Dongola.
- Baqqara*. S. of Kababish, W. of Nile and Bahr-el-Arab.

V. HAMITIC GROUP.

TIBU BRANCH. *Baele, Ennedi, Zoghâwa*. N. of Dar-Fur; N. W. to Wanganya and Borku; Speech like Dasa or So. Tibu; type Negroid.

• BERBER BRANCH. *Fulah*. W. of Dar-Fur.

ish).

Nile,

SO. ETHIOPIAN
BRANCH.

OROMO
OR
GALLA

- Ittu*. Ittu Mts., 41°-42° E., 9°-10° N.
- Carayu*. S. E. of Ankoher.
- Dawari*. W. from Tajurra bay.
- Wolo*. W. of Lake Ardidbo.
- Wooro-Babbo*. E. of Lakes Ardidbo and Haic.
- Mecha*. S. of Gojam.
- Raya, Asabo*. W. of Zebul.
- Lango*. Somerset Nile, Fowura, to Magungo.
- Wa-Huma, Wa-Tusi*. With Bantus, E. Equatorial regions.
- Sidama*. Kaffaland, S. W. of Shoa. Wrongly Nubas.

SOMALI

- Isa, Isa-Ishaai-Modaba, Gudabirsi, Habr-Awal*. Between Zeilah, Harrar and Berbera.
- Habr-Gerhajis*. Uplands S. of Berbera.
- Godahursi, Dalbahantu, Warsingali, Mijjerthain*. E. of Berbera to Indian ocean.

CENTRAL
ETHIOPIAN
BRANCH

AFAR OR
DANAKIL

- Debnet, Asoba, Assa-Imara, Sidi-Habura, Galeila*. Coast between Abyssinia and Red sea, from Zula bay to Strait of Bab-el-Mandeb.
- Khamir* (Lasta district), *Aqau* (Quara district), *Agaumeder* and *Khamant* (Gondar district) of Abyssinia.
- Saho or Shoko*. N. E. frontier Abyssinia.

and

THE RETRIEVING HARPOON; AN UNDESCRIBED TYPE OF ESKIMO WEAPON.—There was found in universal use at Point Barrow, Arctic Alaska, a peculiar form of harpoon, exclusively used, as the name I have suggested for it implies, for retrieving seals that

have been shot in open holes or "leads" of water, within darting distance from the edge of the ice. The Eskimos call it "*nau-lî-gû*."

It consists of a long light shaft (*i-pû-ä*) of wood, about one inch in diameter, and generally about five feet long, though the length varies with the height of the man who uses it. The butt of this is armed with a slender bayonet-shaped ice-pick (*tû-u*) of walrus ivory, about fourteen inches long, and to the other end is securely fastened a heavy pear-shaped foreshaft (*u-ku-mai-lu-ta*, "weight") of walrus ivory or compact bone, which serves to give weight to the head of the harpoon and make it fly straight. It is about five inches long and an inch and a half in diameter at the forward end. In the center of the end of the foreshaft is a deep round socket into which fits the butt of a slender rod of ivory about two inches long, the "loose-shaft" (*i-gi-mû*). This is secured to the foreshaft by a thong passing through a hole drilled in it, so that it can be easily removed from the socket, while the thong prevents it from being dropped and lost. On the tip of the loose-shaft fits a detachable toggle-head (*nau-lû*) of the ordinary type common to the whole Eskimo race, provided with a long line of seal thong upwards of ninety feet in length.

When ready for use the line is drawn taut from the head to about the middle of the shaft, made fast by a couple of half-hitches, and kept from slipping by a little ivory peg (*ki-ler-bwîñ*) inserted into the shaft. Just back of this there is also a little curved ivory knob (*tî-ka*) secured to the shaft as a rest for the forefinger in aiming the weapon.

The hunter on starting out carries his rifle slung in a sort of holster across his back, and secured to this the *nau-lû* and line folded in long hanks. The rest of the harpoon is carried in the hand and serves as a staff in walking and climbing among the ice-hummocks, where the sharp pick is useful to prevent slipping and to try doubtful ice, and also enables the hunter to break away thin ice at the edge of a hole so as to draw his game to the solid floe. It can also serve as a bayonet for defence in case of necessity.

When a seal has been shot and floats, the *nau-lû* and line are fitted on and the weapon darted with the right hand while the left holds the end of the line. The *nau-lû* enters the animal entirely, and a pull on the line causes it to slip off the top of the loose-shaft (which is facilitated by the play of the latter) and to toggle securely under the skin. The whole is then drawn in by the line.

The use of this weapon appears to be confined to Northwestern Alaska, and it is very rarely found south of Bering's strait. In the large collection made by Mr. E. W. Nelson in the neighborhood of Norton sound, there is only one rather clumsily-made *nau-lî-gû*, with a fragment of the line, which is labeled a "beluga

spear." It is manifestly unfitted for such use, but this statement goes to show that it was an unfamiliar weapon among the people by whom he was surrounded. The natives of that region, as well as the Greenlanders and Eastern Eskimos, retrieve seals with the kaiak, occasionally using the stabbing harpoon common to the whole Eskimo race, to secure a seal, but they are unprovided with any special weapon for retrieving.

We were unable, during our stay at Point Barrow, to ascertain whether this weapon was in use before the introduction of firearms, which are now universally employed, but I am strongly led to conjecture that it is a modern invention.

I am of the opinion that the people of this limited area, enabled by the introduction of firearms to kill seals in the open holes of water, where they had previously been safe from the ordinary spear, and prevented from using the kaiak from the extreme roughness of the ice, invented this weapon by reducing the great walrus-harpoon to a convenient size for carrying on the ice. It is a perfect miniature of the walrus-harpoon, with the addition of the ice-pick, an essential part of the ordinary stabbing-harpoon.

I am strengthened in this opinion by the fact that Dr. Simpson, who spent the winters of 1852-3 and 1853-4 at Point Barrow, before the general introduction of firearms, makes no mention of the use of this weapon in his excellent paper on the Western Eskimos. He would undoubtedly have done so had he seen it, so different is it from the ordinary Eskimo methods of seal-hunting.—*John Murdoch.*

MICROSCOPY.¹

LA BIOLOGIE CELLULAIRE.—The first number of a comprehensive treatise on general cytology, bearing the above title, has just been published. Two more numbers are to follow, which will make a large octavo volume of seven or eight hundred pages, illustrated with over four hundred cuts. The price of the first number is twelve francs, while the subscription price of the complete work is twenty-five francs. It may be obtained from H. Engelcke, 24 Rue de l' Université de Gand, Belgium.

The author, J. B. Carnoy, professor of general biology in the Université Catholique of Louvain, has undertaken a comparative study of the cell in both kingdoms, and proposes to make the treatment of the subject as complete and thorough as possible in the present state of our knowledge.

Our notions of the cell have been clearing rapidly in recent years; and, although we are still far from a complete knowledge of this many-sided subject, the time seems to have arrived when cytology may properly be recognized as an independent branch of learning, as it has been for some years in the university of

¹ Edited by Dr. C. O. WHITMAN, Mus. Comp. Zool., Cambridge, Mass.

Louvain. The key to some of the deepest mysteries of life, is to be found, if at all, in the study of the cell; and for this and other reasons that do not call for mention, we are glad to see the subject treated as a science, and not in the narrow methods of a mere historical compendium.

The work is intended for *laboratory use*. "*It is needless to remark*," says the author, "*that no lesson in cytology can be mastered outside of the microscopical laboratory.*" Its aim is to furnish the student with a proper foundation for the study of life in any of its aspects, and both student and teacher with a guide to the most favorable objects of study, and the best instruments and methods now in use.

Thus stated, the chief aim of the work would seem to be nearly identical with that of the well-known Practical Biology; but the subject-matter and the method of dealing with it are quite unlike in the two cases. Huxley's course deals with the morphology and physiology of a few typical vegetable and animal organisms; Carnoy's course deals with the chemistry as well as the morphology and physiology of the cell, as the structural unit of all organisms. The one makes use of both macroscopical and microscopical methods of observation; the other employs almost exclusively methods of microscopical technique. The Practical Biology pursues methods of its own, and aims to impart, through laboratory work, such information as should form a part of so-called general education; the Cellular Biology limiting itself to a single subject of general and fundamental importance, proposes to deal with it in an encyclopedic fashion and thus to lay a broad and solid foundation for special study in botany, zoology, or physiology. The former points out the direct way to a system of facts, and deals very sparingly in interpretation; the latter adds to its facts and methods, history, discussion, and general interpretation. The English manual is an excellent guide for the general student, who merely desires some knowledge of typical organisms; but the training it offers, though admirable as far as it goes, falls short, in some important particulars, of being an adequate preparation for original investigation in either of the above-named departments of biology. The French manual, if completed with the thoroughness that characterizes the first number, will furnish, in our opinion, not only a much-needed book of reference, but also a course of study which exactly meets the needs of those who are preparing for independent work.

The general scope of the work may be seen from the following introductory remarks by its author: "A course in general cytology should embrace the study of both the animal and vegetable cell. * * * The essential characters of organization, and the fundamental biological laws, are the same for all living beings. * * * It is only after having searched the two kingdoms, after having followed the organized element step by step, and through

the entire series of living forms, that it becomes possible to gain a conception of it, which can be called exact, truly scientific and fruitful.

"Cytological instruction should be *complete* and *searching*. In order to be complete, it should survey the cell from all sides, from the standpoint of morphology, anatomy, physiology and biochemistry; for it is under these several aspects that it will serve as a basis for subsequent study. In saying that it should be searching, we should take care to demand that it be encyclopedic; a course which loses itself in details would not be thorough. What we desire is, that the student shall be made to penetrate into the inner life of the cell, and actually to lay hold of both the essential and accidental chemical constitution of living matter, the fundamental organic constitution of different parts of the cell—membrane, protoplasm, nucleus; to reflect long upon the principal physiological phenomena—indispensable foods, elaboration, digestion, assimilation, &c.; upon the general movements of the cell—cleavage, fecundation, different movements of the protoplasmic reticulum; upon differentiation, cellular geotropism and heliotropism," &c., &c.

The first part of this first number of the work containing 167 pages, is devoted to the instruments and methods of microscopical research. The first of the three books into which it is subdivided, treats of the microscope and its accessories, the microspectroscope, polarizing apparatus, the micrometer, goniometer, photographic apparatus, and camera lucida; and closes with a chapter on the laboratory, aquaria, and reagents.

The second book considers the objects or materials of study, and the methods of preparation, including the microtome and its uses.

The third book devotes one chapter to "the education of the eye," another to "the examination and treatment of preparations," and a third to "the method to be pursued in scientific researches and publications."

The second part opens with a valuable historical preliminary, and a discussion of general notions of the cell, including terminology and definitions. Then follows a book of sixty-five pages devoted to the *nucleus*—its chemical constitution, structure, and morphography. The remaining three books of this part, dealing with *protoplasm*, the *cell-membrane* and *general discussions*, will appear in the second number.

The historical summaries, and well-arranged bibliographical references, form a very valuable feature of the work; and the same may be said of the chapters devoted to methods of research, which contain much that is new. The cuts are *all* original. They are well executed, and for the most part well chosen; but this is a point in which originality might have been curtailed and well selected illustrations borrowed from different sources.

Professor Carnoy has undertaken an extremely difficult task, and the success with which he has accomplished the first part is a sufficient guaranty of an equally successful conclusion. The best that we can wish for it is, that it may meet with a reception as favorable as it deserves.

PERGENS'S PICROCARMINE.¹—I. 1. Boil for two and a half hours 500 grms. pulverized cochineal in thirty liters of water.

2. Add fifty grms. *potassic nitrate*, and, after a moment of boiling, sixty grms. *oxalate of potash*; boil fifteen minutes.

3. After cooling, the carmine settles: it is washed several times with distilled water in the course of three or four weeks.

II. 4. Pour a mixture of one volume of ammonia with four volumes of water upon the carmine, taking care that the carmine remain in excess.

5. After two days filter, and leave the filtered solution exposed to the air until a precipitate forms.

6. Filter again, and add a concentrated solution of picric acid; agitate, and then allow it to stand twenty-four hours.

7. Filter, and add one gram chloral for one litre of the liquid.

8. At the end of eight days, separate the liquid from the slight precipitate which is formed, and it is ready for use.

This fluid keeps unchanged for at least two years, and is recommended by Carnoy above other picrocarmine solutions.

PROCEEDINGS OF THE AMERICAN SOCIETY OF MICROSCOPISTS.²—The seventh volume of the Proceedings of the American Society of Microscopists contains, besides President Cox's address on Robert B. Tolles, about forty articles, some of which contain valuable information for the microscopist. We may call especial attention to the articles on Photomicrography by the President and H. F. Atwood; the observations of the editor in chief, Dr. D. S. Kellicott, on Infusoria, Rotatoria, &c.; thoughts on Sponges by Henry Mills; a new mounting medium by H. L. Smith; serial sections by S. H. Gage; hints on hardening, imbedding, cutting, &c., by Geo. Duffield; a cover-glass cleaner by T. L. James; the ideal slide by F. M. Hamlin; the magnifying power of objectives and lenses by W. H. Bulloch; a method of staining and mounting by J. T. Brownell; a lens holder by R. H. Ward; an improvement in objectives by Ernst Gundlach. The volume contains other articles of more or less interest, report of committee on standard micrometer, and on oculars.

JOURNAL OF THE NEW YORK MICROSCOPICAL SOCIETY.—The first number of this new microscopical journal contains an interesting article on Electrical Illumination in Microscopy, by E. A. Schultze; and another entitled Criticisms on Mr. J. Krutt-

¹ *Biologie Cellulaire*, by J. B. Carnoy, p. 92, 1884.

² Seventh Annual Meeting, held at Rochester, N. Y., Aug. 19-22, 1884.

schnitt's Papers and Preparations relating to Pollen-tubes, by N. L. Britton. The rest of the number is given to the Proceedings of the Society, Miscellanea, and an Index to Articles of Interest to Microscopists.

In the meeting of December 5th, J. D. Hyatt speaks of Hydrogen Peroxide as a Bleaching Agent, but gives no details of the process.

This journal is edited by Benjamin Braman, and is to be published in nine monthly numbers, from November to July, inclusive.

METHOD OF MAKING ABSOLUTE ALCOHOL.—Dr. Sharp states that absolute alcohol is prepared in Ranvier's laboratory by adding anhydrous cupric sulphate to ninety-five per cent alcohol.¹

Pulverized cupric sulphate is heated to red heat in order to drive off the water of crystallization; when cool the white powder is placed in a wide-mouthed bottle, holding about a liter, and three-fourths full of alcohol. The bottle is quickly closed and the whole shaken. After standing a day or more—with occasional shakings—it is decanted and the operation repeated, especially if the cupric sulphate shows much of the blue color due to the reassumption of water.

As a test a drop of the alcohol thus dehydrated may be mixed with a drop of turpentine on a glass slide, and examined under the microscope; if no particles of water are to be seen the alcohol is absolute enough for all practical purposes.

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SCIENTIFIC NEWS.

—Mr. J. Dillon forwarded a paper to the Montreal meeting of the British Associations on an automatic sounder for the use of the explorer, in determining depths in rivers and lakes, and the character of the bottom. Over the side of the vessel is a long sounding bar or tube, in length $10\frac{1}{2}$ feet, or more, which bar works freely round a fixed center inside the boat. This fixed center is placed in the middle of a circular dial on which are marked fathoms or feet, a duplicate dial being placed in the captain's cabin. On mooring the boat over a shoal rising to the surface, the sounding bar, which always hangs vertically, will strike the shoal from its weight. The bar will run along the ground, pointing to the number of feet on the dial, representing the depths of the shoal under the surface of the water. It has been found that the vibrations of the sounding bar differ in degree when the boat moves it along different formations, thus enabling the observer, after very short experience, to record in his note-

¹ Roscoe and Schorlemmer state that anhydrous cupric sulphate is a good test for the presence of water, but not a suitable means for preparing absolute alcohol.

book whether the surface of the ground under the water is composed of mud, sand, gravel, boulders or rock.

—The Department of Biology of the University of Pennsylvania, which promises to be one of the leading schools of the "science of life," has been formally opened. Dr. Joseph Leidy is director of the department. Its aim is to encourage original research in biology, by offering facilities to scientists engaged in investigation and by giving instruction to advanced students prosecuting special work. The university has rented a table at Dr. Dohrn's Zoölogical Station, Naples, Italy, Dr. Charles Dolley being its representative. Mr. Edward Muybridge, whose attention to the study of the motion of animals and the illustration of them by instantaneous photographs has gained him favorable mention throughout the country, will work with the faculty, in photographing, and will give instruction in this branch to those who desire it.

Further information respecting the department may be obtained from Professor H. F. Jayne, M.D., secretary of the faculty, 1826 Chestnut street, Philadelphia.

—The third volume of the memoirs of the National Academy of Sciences, which has been transmitted to Congress by its president, Professor O. C. Marsh, of New Haven, contains the proceedings of the academy for 1884, and the following papers: 1, The sufficiency of terrestrial rotation for the deflection of streams, by G. K. Gilbert; 2, On the temperature of the surface of the moon, by Professor S. P. Langley; 3, On the determination of the laws of the vibration of tuning forks, with special reference to the action of a simple chronoscope, by Professor A. M. Mayer; 4, On the Baume hydrometers, by Professor C. F. Chandler; 5, On small differences of sensation, by Professor C. S. Peirce and J. Jastron; 6, Description of an articulate of doubtful relationship from the tertiary beds of Florissant, Colorado, by Dr. S. H. Scudder; 7, The structure of the Columella auris in the Pelycosauria, by Professor E. D. Cope; 8, On the structure of the brain of the sessile-eyed Crustacea, by Professor A. S. Packard.

—The existence of a cavern in the neighborhood of Beaver hole, on Cheat river, near St. George, W. Va., has been known for years; but it was never explored until the past week, when a party of men devoted a day to an examination of the cave. It proves to be a remarkable cavern, or rather a series of caverns, for there are five of them, one above the other. The lower one was explored a distance of a mile, and the upper one two miles. There is a small stream in the lower one, but the upper one is comparatively dry. The rooms are large and have evidently been cleared of debris at some former period. In one evidence of a fire was found, and the remnant of bones, which were brought

out and will be sent to an antiquarian for identification. The cave is almost on the line of the new West Virginia Central Railroad.

—The Amsterdam *Allgemein Handelsblad*, publishes a communication from Professor Cohn, recapitulating the substance of the correspondence between Leeuwenhoek and Francis Aston, F.R.S. The celebrated naturalist, writing from Delft in 1683, tells Aston how, with the aid of the microscope, he had discovered and distinguished minute organisms amongst the particles of food removed from between his teeth. In 1692 Leeuwenhoek sent sketches of these organisms to the Royal Society; but he experienced a period when he could not discover any traces of them, and attributed their disappearance to the use of hot coffee.—*English Mechanic*.

—The works of Darwin are not allowed to be issued from the circulating libraries of Russia, and a recent imperial decree puts those of Agassiz, Huxley, Lubbock, Adam Smith, Lewes, and Spencer on the same list. The new list is not confined to English and American authors, for Moleschott, Büchner, Vogt, Reclus, and others are considered unsuitable for Russian readers.

—The death is announced of Mr. John Gwyn Jeffreys, LL.D., F.R.S., the distinguished conchologist and naturalist. Mr. Jeffreys was born at Swansea, in 1809, and was called to the bar; but about twenty years ago he retired from practice, and devoted himself entirely to his favorite branch of science. In his early life he was an enthusiastic dredger, and as soon as he was able purchased a yacht in order the better to prosecute his work. When the *Porcupine* was fitted out in 1869, in company with Dr. Carpenter and the late Sir Wyville Thompson, Mr. Jeffreys conducted the exploring voyages, and subsequently superintended the scientific work of the *Valorous*, when that frigate accompanied our latest Arctic expedition as far as Davis straits. His first paper was contributed to the transactions of the Linnean Society at the early age of nineteen, and since then his contributions to the transactions of the Royal and other societies, have been both numerous and valuable.

—Professor Lauritz Esmark, director of the zoölogical museum of the University of Christiania, Norway, died in December last. He once spent nearly two years in this country, traveling extensively, and was hospitable to American naturalists visiting in Norway.

—Vice-Admiral H. W. Bayfield died at Charlottetown, N. S., February 12, aged 90 years. He will be remembered for his surveys of the St. Lawrence gulf and the coast of Labrador.

—The death is also announced of Dr. Friedrich von Stein, professor of zoölogy and zoöotomy in the University of Prague for thirty years. Professor Stein was sixty-seven.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BIOLOGICAL SOCIETY OF WASHINGTON, Feb. 7.—Communications were made by Dr. H. G. Beyer, U. S. N., report on intracellular digestion and its relations to pathology; by Dr. J. A. Ryder, on the probable origin and homologies of the flukes of Cetaceans and Sirenians.

Feb. 21.—Communications were made by Dr. Theodore Gill, on the relative values of different types in palæontology; by Dr. H. G. Beyer, U. S. N., on genital apparatus of Lingula; by Mr. J. L. Wortman, on a method for exhibiting the relationships of the bones of the skull; by Mr. Frederick W. True, on the recent capture of right whales off Long Island.

APPALACHIAN MOUNTAIN CLUB, Feb. 13.—A lecture on Colorado, New Mexico, and Utah, illustrated by stereopticon, was given by Rev. A. E. Winship.

BOSTON SOCIETY OF NATURAL HISTORY, Feb. 4.—Mr. Wm. M. Davis read a paper on geographic evolution, illustrated by models for use in teaching.

AMERICAN GEOGRAPHICAL SOCIETY, Feb. 26.—David Dudley Field, delivered a lecture entitled, Nomenclature of cities and towns in the United States.

NEW YORK ACADEMY OF SCIENCES, Jan. 19.—The following paper was read: Glacial observations in Canada and on the Northern borders of the State of New York, by Dr. A. A. Julien; Prof. D. S. Martin exhibited some views and photographs of interesting geological scenery.

Feb. 9.—The following paper was read: Tin deposits in the Black Hills of Dakota (illustrated with specimens and photographs), by Prof. G. E. Bailey.

PHILADELPHIA ACADEMY NATURAL SCIENCES, Dec. 4.—Professor Heilprin gave the result of his examination of fossiliferous pebbles from near the East Park reservoir. Most of the fossils are barely recognizable as organic remains, but *Spirifer perlamilosus* could be identified. The formation represented by these pebbles is the Decker's Ferry sandstone connecting the Oriskany with the Lower Helderberg beds. This deposit extends in a south-western direction from about thirteen miles north of the Delaware Water gap. The same speaker also showed specimens of rock from New York containing particles and masses of serpentine closely resembling the so-called *Eozoon canadense*, yet with sufficient difference to show clearly that they were formed by mineral accretion. Professor Heilprin held that these specimens were enough to prove the non-organic nature of *Eozoon*.

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